RAILWAY MISMANAGEMENT IN NEW SOUTH WALES.

We dealt so fully with this subject in our issue of Sept. 30th, has to leave little, as it then appeared to us, to be said in reference to it. But since the date of that article, the newspapers received from the colony have brought particulars of a new phase on which the case has entered, which gives occasion for further comment.

It appears that the more independent section of the local press did not, in common with ourselves, share the views of the departmental Board as to the cause of the accident on the Hawkesbury line, prominent amongst which was the Sydney *Daily Telegraph*. This newspaper, laying stress on the findings of the coroner's jury, and on the "dreadful revelation of all-round laxity" resulting from the "demoralised condition of the Railway Department," as the writer aptly expressed it, saw proper to question the soundness of the Board's theory of "exhaustion of air" by the driver, and advanced cogent reasons against the theory, and, as a consequence, against the acquittal by the Board of the traffic department of blame for the accident in respect of the closed tap. This, as was only natural, was viewed by the railway authorities—conscious, doubtless, of the damaging character of the criticisms—as too serious to be passed over. The Commissioner for Railways, hastening to the fray in a manner hardly consistent with freedom from partisanship or a judicial frame of mind, and descending for the nonce from the usual high estate of official reserve, forthwith addressed a minute to the departmental Board, calling its attention to the columns of the *Daily Telegraph*, and, after broadly insinuating, in a style unusual in official correspondence, that the editorial in that paper was written from interested motives on behalf of the Westinghouse Brake Company, requested a report from the Board on the article. The Commissioner's minute is a remarkable one, and is worth reproducing. It runs thus:—"There is an article contributed to the *Daily Telegraph* to-day—contributed, it is obvious, from its tone, argument, and concluding challenge, by some one who has a direct interest in the Westinghouse brake—respecting what the writer is pleased to call 'the exploded theory of the Board.' I should like to have the report of the Board on that article." The minute then goes on to note points in the arguments of the *Daily Telegraph*, which were evidently intended to serve as cues for the guidance of the Board in their reply. In response to this, the Board, as represented now by a single individual, the Secretary for Railways, who, as chairman of the Board, signs the document—the other members being at this juncture apparently passive spectators of the scene—addressed to the Commissioner a reply of almost interminable length, with the arguments in which we shall hereafter deal.

Before doing so, however, we would say, in reference to this new phase of the subject, that the first point which suggests remark is that the railway authorities, as represented by the Commissioner, in thus entering on a controversy with the press, show in a marked degree a consciousness of the weakness of their position. When a Corporation finds it necessary to "explain,' it clearly, as in the case of ordinary individuals, confesses to the unsatisfactory nature of its position, and the want of cohesion in its original arguments. True, the Commissioner for Railways, as if desirous of cloaking the damaging nature of the proceedings, said in a minute at the foot of the Board's reply:—"The department cannot enter into controversy with writers in the press." He nevertheless added:—"But if the press would like to make use of this special report, I do not see any objection to it," and forthwith handed it over to the daily papers for publication—a proceeding which, as the Sydney *Daily Telegraph* points out, is controversy pure and simple, if anything is. But that is comparatively a small matter. What is more important to notice is the position taken up by the Commissioner for Railways, and endorsed by the Board in even stronger and more offensive terms, in questioning the *bona fides* and disinterestedness of the *Daily Telegraph*. Its importance consists in this, that it leads one naturally to inquire, in the first place: In what position the Commissioner himself stands with reference to the accident, as well as to the Board? and, secondly, who the individuals are who compose the Board, and what are their relations, severally, to the departments more immediately concerned in the accident?—as affording some means of judging of their own *bona fides* and disinterestedness in the matter, and their title to impugn the honesty of those who, in the exercise of their undoubted right, see proper to question the soundness of their conclusions.

On looking into the matter, the first thing we find from the particulars supplied by the local press is that the members of the Board were nominated by the Commissioner for Railways, the chief permanent official responsible under the existing Railway Act, to the Government for the safe conduct of the traffic. In the second place, we find that the members of the Board consist of the traffic manager, the assistant permanent way engineer, the superintendent of tramway rolling stock, and the Secretary for Railways; while neither the locomotive engineer, nor anyone on his staff, is on the Board. In the next place, we find that when the selection of the Board was called in question in the Legislative Assembly, the Minister for Works, in justifying, seemingly, the obvious bias in the selection of the Board, stated that "none of the officials of the Board had anything to do with the departments connected with the accident," although it had been said a few minutes previously in the House by the Prime Minister, on the strength of a memorandum furnished to him by the Commissioner for Railways, that "it was impossible to say at the present time what the primary cause of the accident was"—a contradiction of statement which, in our opinion, showed an unmistakeable prejudgment of the case to the prejudice of the locomotive department. Further, as an element in the question, it should be stated that the tary for railways was, as the Blue-books of the department show, traffic manager prior to his appointment to his present position, and therefore, it may reasonably be supposed, not altogether out of sympathy with the habits of thought and traditions of that conspicuously disorganised branch of the service. Further, as appears from a statement made by a speaker at a public meeting at Sydney a few days after the appointment of the Board, as reported in the *Sydney Morning Herald*, another member of the Board "had had a long and severe battle with the locomotive engineers, and that of such a nature that it caused a transfer from the locomotive to the tramway department." With regard to the remaining members, it may be said of the assistant permanent way engineer, that however highly qualified he may be for his position in his own special branch of engineering, he is not necessarily fitted by experience in the use of brakes, or in the working of railways, to form a just or authoritative opinion on the question submitted to the Board; while, as regards the traffic manager, it is only reasonable to say that he would naturally safeguard the interests of himself and of those under him for whose conduct he was primarily responsible. So much for the qualifications of the members of the Board of Inquiry, and for the impartiality and freedom from personal interest shown by the railway authorities in their selection.

In the face of such a record against the Board, what is to be thought of the following sentences in the reply made on their behalf to the cogent criticisms passed upon them by our Sydney contemporary. They are made to say:—"The *Daily Telegraph* contributor is simply trying to blind the eyes of the public to a defect in the Westinghouse brake, which is no doubt mainly noticeable on long and steep descending gradients, where the frequent application of the brake is necessary to check the speed of the train, but the safety of public life and limb is of so much more importance than the reputation of any brake, that if in showing the unreliable character of the writer's arguments and conclusions we shall have occasion to refer to the deficiencies of the Westinghouse brake, it will be more with a desire to insure that object than to speak in disparaging terms of a brake which has some admirable qualities. In his desire to save the reputation of the brake, our critic is apparently indifferent whether he attains his object at the expense of the servants of the railway department in relation to the performance of their duties or not."

The high-toned allusion in these sentences to the safety of public life and limb comes with little grace or force from a Board containing the head of the department which despatched the ill-fated train on Jubilee day in disregard of well-nigh half-a-dozen traffic rules laid down for the express purpose of securing the "safety of public life and limb," and for the disregard of which the Board had not a single word of condemnation to say in their report to the Government. Next, as regards their patronising expression of desire not "to speak in disparaging terms of a brake which has some admirable qualities," we need merely remark that we fancy the brake will be able to hold its own, notwithstanding anything the Board has advanced or can advance against it in this particular case. But as regards the Board's unseemly charge against the writer of the article in the *Daily Telegraph*, we think our readers, in common with the public of New South Wales in general, will be inclined to ask whether the Board are not themselves open to the charge—to use their own style of language—of trying to "blind the eyes of the public" to a gross neglect of duty on the part of the traffic department, which caused the accident, and that "in their desire to save the reputation" of a colleague on the Board and that of those superior to him, who are responsible for the laxity of management which is a disgrace to the Railway Department, as well as to the Colony itself, they were, and are now, "indifferent whether they attain their object at the expense" of the reputation of the dead engine driver and the locomotive department he served, or not.

We must defer to a subsequent issue, dealing with the arguments urged on behalf of the Board in defence of its "exhaustion of air" theory.

DECREASE OF THE IRON MANUFACTURE IN FRANCE.

The influences supposed to operate by those who take a pessimist view of the state of British industries, will not find much support from the recent returns concerning French iron and steel trades and mining industries. The *Journal Officiel* brings the following statistics concerning the French mines, &c., for 1885 and 1886:—The number of mines at work had sunk from 504 to 476, or a reduction of twenty-eight. Of 1380 concessioned mines therefore only 904 were worked. Of the 476 which are worked-only 204 yielded any profit. Two-thirds of the mines which are worked are collieries, and they employ nine-tenths of all the miners, and had an output of 19,500,000 tons of coal, 500,000 less than in 1884 and 2,000,000 less than in 1883. The selling price fell 60c. as compared to the year before; still the selling price at the mines reached 11·73f, per ton. The cost of getting fell 43c. from that of 1884. The number of workpeople engaged was 111,500, nearly 10,000 fewer than in 1884 and 15,000 less than in 1883. There was an increase of output of 543,000 t., in 1886, against that of 1885. The decrease in the production of iron is remarkable. In 1883 it amounted to 2 million tons of cast iron and 1½ million tons of manufactured iron and steel; in 1884, 1,872,000 t. of crude, and 1,380,000 t. of iron and steel; in 1885, the two quantities were 1,634,000 t. and 1,336,000 t.; and in 1886, 1,508,000 t. and 1,234,000 t. The number of steam engines working steadily increased, but for the most part in small factories and in agriculture, whilst those in large industrial establishments decreased. The number of steam vessels, curiously enough, has remained almost stationary, although, by the law of 1883, the State has paid to the commercial marine—as premiums for registered bought vessels, for building new ones, and on cargo freights—a sum of 26 million francs, not reckoning the regular subventions to post-steamers, Equally noteworthy is the fact that the number of locomotives on the railways had decreased from 9241 to 9150, although 1461 kom. of new lines had been opened.

STRUTS—THEIR WORKING STRENGTH AND STIFFNESS.

By Professor R. H. Smith.

No. II.

Next may be mentioned the paper by Professors Ayrton and Perry that appeared in The Engineer of 10th and 24th December, 1886. In this the results (e) and (g) are combined as two terms added in one formula. The authors found that the two functions $\sec.\left(\frac{\pi}{2}\sqrt{\frac{w}{\beta}}\right)$ and $\frac{\beta}{\beta - w}$ varied very similarly, and in consequence abandoned the former and adopted formula (g) pure and simple. They showed that the deflections Δ calculated by (g) indirectly by the help of experiments agreed very fairly with the direct experimental measurements of these deflections. If $\frac{w}{\beta}$ were as much as ·95, the first of the above two functions would be one and a-quarter times the second, but safe struts must always have $\frac{w}{\beta}$ very much lower. When it is ·5 the first is one and one-eighth times the second, and when $\frac{w}{\beta}$ is small the difference between the two is minute. For the majority of struts, therefore, (g) may be taken as a safe guide, but it should not be forgotten that the use of (e) in preference to (g) is a choice in the direction of *safety*, and also that it must be taken as a closer representation of the actual truth.

All these results from (e) onwards refer to struts hinged at both ends. They all look much simpler than they really are. If the problem in hand be simply to find out what is probably or possibly the maximum stress in a strut of known dimensions and under known load, then there is no difficulty in calculating β at once, and either (g) or (e) may be used *directly* without any trouble to find k, although, of course, there is an element of uncertainty in the estimation of the excentricity e or ϵ.

But this is not the problem proposed for the present paper. We wish now to use these results in showing how to design the proper size of section for a strut of given *length*, *material*, and to be subjected under a given *load* to not more than a given *stress* k, judged safe for that material. Regarding what ought to be taken as the safe k in solving this problem of practical design we will speak later. Meantime it may firstly be remarked that both Mr. Fidler and Professors Ayrton and Perry seem to think that the solution of this practical problem is to take (f) or (g) as a quadratic equation for finding w in terms of β and the other quantities. They both give the solution of this quadratic in this form. This, however, if they or their readers have formed that opinion, is a complete misapprehension which must necessarily be removed the first time it is attempted to use the equation for this purpose. It is so because β implicitly involves w, seeing that in order to find β one must know the section. Taken as equations for determining the section, either of them is really a cubic or a sextic equation, according to circumstances.

This is evident when the values of w and β are inserted in (g) as below:

$$k = \frac{W}{s\,h^2}\left\{1 + \frac{s}{2\,i}\cdot\epsilon\cdot\frac{h^4}{h^4 - \frac{W\,L^2}{\pi^2\,i\,E}}\right\} \quad . \quad . \quad (g)$$

If $\epsilon\,h$ be assumed as known independently of h, this would be an equation of the sixth power for finding h. If, however, the ratio ϵ of the excentricity to cross-dimension be assumed as one of the data, then it is a cubic in terms of h^2.

It will be found that the only practicable way of solving this cubic is by trial and error, and the form given above is as convenient as any other for this method of solution. If the trial-and-error mode of solution be adopted, it is practically as easy to solve it as a sixth-power formula as a cubic.

Take an example of its solution with the following data:—

$$\text{Data}\begin{cases} \left.\begin{aligned} W &= 100{,}000\text{ lb.} = 10^5. \\ L &= 500\text{in.} \\ E &= 3 \times 10^7 \\ k &= 10{,}000 = 10^4 \end{aligned}\right\}\text{lbs. per sq. in.} \\ \text{Square box section } \frac{t}{h} = \cdot 02. \\ \epsilon = \cdot 1. \end{cases}$$

From No. 5 section in table we obtain

$$s = 4\,\frac{t}{h} = \cdot 08,$$

$$i = \frac{2}{3}\,\frac{t}{h} = \frac{4}{300},$$

$$\frac{s}{2\,i} = 3.$$

We will take π^2 approximately $= 10$.

If the load were equally distributed over the section, the section required would be $W \div k = 10^5 \div 10^4 = 10$ sq. inches.

But we should have

$$10^4 = k = \frac{10^5}{\cdot 08\,h^2}\left\{1 + \frac{3}{10}\cdot\frac{h^4}{h^4 - \frac{10^5 \times 25 \times 10^4 \times 300}{10 \times 4 \times 10^7 \times 3}}\right\}$$

or

$$10^4 = \frac{125 \times 10^4}{h^2}\left\{1 \times \frac{3}{10}\cdot\frac{h^4}{h^4 - 6250}\right\}.$$

The first rough approximation is obtained by supposing the increase of central deflection due to loading to be inappreciably minute in comparison with $\epsilon\,h$; that is, we put $\frac{h^4}{h^4 - 6250} = 1$. This gives $h^2 = 1{\cdot}3 \times 125 = 162{\cdot}5$, and $h = 12{\cdot}7$. We know that the true $h > 12{\cdot}7$.

We guess $h = 15$, and obtain

$$\frac{10^4 \times 125}{15^2}\left\{1 \times \frac{3}{10} \cdot \frac{15^4}{15^4 - 6250}\right\} = \cdot 86 \times 10^4.$$

This ·86 is less than 1, and indicates that $h = 15$ gives the maximum stress less than 10^4. Therefore h may be taken less than 15. Try $h = 13$. Then—

$$\frac{10^4 \times 125}{13^2}\left\{1 + \frac{3}{10} \cdot \frac{13^4}{13^4 - 6250}\right\} = 1 \cdot 02 \times 10^4$$

This $h = 13$ therefore gives the maximum stress 2 per cent. greater than it was intended to be. A slightly larger size than 13in. will, therefore, be sufficient, and the necessary section is a little more than $\cdot 08 \times 13^2 = 13\frac{1}{2}$ sq. inches, the thickness of the plates being $\cdot 02 \times 13 = \cdot 26$. The outside edge of the square should be rather greater than $13 + \frac{1}{4} = 13\frac{1}{4}$in. An outside edge of 14in. with $\frac{1}{4}$in. plate thickness would give the section $= 13\frac{3}{4} \times \frac{1}{4} \times 4 = 13\frac{3}{4}$ square inches, and this is, therefore, a suitable size. Evidently, however, to avoid risk of buckling it would be desirable to have thicker plates, and to illustrate further the use of this rule, we give below the calculation over again with $\frac{t}{h} = \cdot 04$ instead of ·02, the other data remaining as before. We then find—

$$s = \cdot 16$$

$$i = \frac{8}{300}$$

$$\frac{s}{2i} = 3$$

and—

$$10^4 = k = \frac{10^5}{\cdot 16\, h^2}\left\{1 + \frac{3}{10} \cdot \frac{h^4}{h^4 - \frac{10^5 \times 25 \times 10^4 \times 300}{10 \times 8 \times 3\,10^7}}\right\}$$

$$\text{or } 10^4 = \frac{625 \times 10^3}{h^2}\left\{1 + \frac{3}{10} \cdot \frac{h^4}{h^4 - 3125}\right\}$$

If the last factor were put = 1, it would give $h^2 = 62 \cdot 5 \times 1 \cdot 3 = 81 \cdot 25$, and, therefore, h over 9. If h be taken = 10in., the right-hand side, *i.e.*, the maximum stress would be $\cdot 898 \times 10^4$. If next we take $h = 9 \cdot 6$in., we find $k = \cdot 999 \times 10^4$, which is close to the stress given as safe. The solution of the problem is, therefore,

$h = 9 \cdot 6$in.
$t = 9 \cdot 6 \times \cdot 04 = 0 \cdot 384$in.
Outside edge $= 9 \cdot 6 + 0 \cdot 384 = 9 \cdot 984 =$ say 10in.
$S = \cdot 16 \times 9 \cdot 6^2 = 14\frac{3}{4}$ square inches.

These results give the average stress $w = 10^4 \times \cdot 678$, and $\beta = 10^4 \times 1 \cdot 843$, so that to obtain the result from the German formula—Euler's—one would need to divide by a "factor of safety" three times greater than that used with the above rule (g).

Transforming formula (e) in a similar way, so as to be more readily usable in designing, we obtain it in the shape—

$$k = \frac{W}{s\,h^2}\left\{1 + \frac{s}{2i} \cdot e \cdot \sec.\left(\frac{L}{2\,h^2}\sqrt{\frac{W}{i\,E}}\right)\right\} \quad . \quad (e)$$

Taking the data of the last problem with $e = \cdot 1$ and $\frac{t}{h} = \cdot 04$, and using (e) we have—

$$10^4 = k = \frac{10^5}{\cdot 16\, h^2}\left\{1 + \frac{3}{10}\sec.\left(\frac{250}{h^2}\sqrt{\frac{10^5 \times 300}{8 \times 3 \times 10^7}}\right)\right\}$$

$$= \frac{625 \times 10^3}{h^2}\left\{1 + \frac{3}{10}\sec.\left(\frac{88 \cdot 39}{h^2}\right)\right\}$$

Using Chamber's tables of "Circular Measure of Arcs" and of "Natural Secants," we find from this that $h = 10$ gives $k = 10^4 \times \cdot 92$; that $h = 9 \cdot 8$ gives $k = 10^4 \times \cdot 97$; and that $h = 9 \cdot 7$ gives $k = 10^4 \times 1 \cdot 002$. The solution is, therefore,

$h = 9 \cdot 7$in.
$t = 9 \cdot 7 \times \cdot 04 = 0 \cdot 388$in.
Outside edge $= 9 \cdot 7 + \cdot 388 = 10 \cdot 088 =$ say $10\frac{1}{10}$in.
$S = \cdot 16 \times 9 \cdot 7^2 = 15$ square inches.

It is apparent that these two formulæ give results very nearly identical. The last used (e) really involves less arithmetical labour than the other, provided one makes free use of "tables;" it is, as already explained, more accurate, and it differs from the other in the direction of safety.

The following are some further numerical illustrations of the application of this last formula (e):—

Data:—

L = 30ft. W = 120 tons. E = 12,000 tons per sq. in.

$k = 8$ tons per square inch. $e = \frac{1}{8}$.

Results:—

Section I.—Solid square, requires $h = 7 \cdot 08$in. $S = 50\frac{1}{8}$ square inches. $w = 2 \cdot 4$ tons per square inch.

Section VI.—Solid circular, requires $h = 8 \cdot 31$in. $S = 54\frac{1}{4}$ square inches. $w = 2 \cdot 21$ tons per square inch.

Section VIII.—Round tube with plates $1\frac{1}{4}$in. thick, requires $h = 8 \cdot 56$in. $S = 33 \cdot 62$. $w = 3 \cdot 37$ tons per square inch.

Section V.—Square tube with plate $1\frac{1}{4}$in. thick, requires $h = 6 \cdot 67$in. $S = 33 \cdot 35$ square inches. $w = 3 \cdot 4$ tons per square inch.

Section X.—With plates $1\frac{1}{4}$in. thick, requires $h = 11 \cdot 27$. $S = 48 \cdot 06$ square inches. $w = 2 \cdot 5$ tons per square inch.

If the load were uniformly distributed over the section, the area required would be $S = \frac{120}{8} = 15$ square inches.

These illustrations are sufficient to show how large an influence upon the strength of a strut is due to a comparatively small deviation of resultant load from centre of end section.

It may be objected that no direct solution of the problem of design has been given above; that the use of the formula by "trial and error" is a lame conclusion to arrive at. The writer considers this objection a pedantic one, and wishes that the great conveniences and rapidity of this method in many circumstances were better understood than it is. Engineers not unfrequently simply stare in amazement or else laugh derisively at any proposal that they should use an equation whose algebraic solution is either complicated and difficult, or "transcendental" in the technical sense. If they would only divert their attention from the algebraic complexity, or perhaps impossibility, of the problem, and practise this method of trial and error, they would cease to be afraid of looking upon apparently complicated results as useless. One of its advantages is that an algebraically complicated equation requires for its solution by "trial and error" very little more arithmetical labour than an algebraically simple one. Another advantage of this method is that it requires nothing but the most elementary algebraic knowledge to enable one to deal with the most complex results. Skill in using it depends chiefly on practice and common sense, and those who do use it know that, skilfully employed, it usually involves hardly any more arithmetical labour than does the solution of any ordinary quadratic.

Further on, however, we give a solution with the help of a set of curves that requires only direct and straightforward calculation without "trial and error."

This equation, viz.,

$$k = \frac{W}{s\,h^2}\left\{1 + \frac{s}{2i} \cdot e \ \sec.\left(\frac{L}{2\,h^2}\sqrt{\frac{W}{i\,E}}\right)\right\}$$

certainly does not exhibit in a very comprehensible manner the general influence of the *length* of the strut upon its strength and stiffness. As this is a most interesting point, it is not well to leave it to be elucidated by the numerical results of numerous examples. Transformed so as most clearly to exhibit the variation of the length L with the other quantities, the two rules (e) and (g) become

$$\left.\begin{aligned} L &= 2S\sqrt{\frac{i}{s^2}\cdot\frac{E}{W}}\ \text{sec.}^{-1}\left\{\frac{2i}{se}\left(\frac{kS}{W} - 1\right)\right\} \\ &= 2h\sqrt{\frac{i}{s}\cdot\frac{E}{w}}\ \text{sec.}^{-1}\left\{\frac{2i}{se}\left(\frac{k}{w} - 1\right)\right\} \end{aligned}\right\} \quad . \quad . \quad (e)$$

$$\left.\begin{aligned} \text{and } L &= \pi S\sqrt{\frac{i}{s^2}\cdot\frac{E}{W}}\sqrt{1 - \frac{1}{\frac{2i}{se}\left(\frac{kS}{W} - 1\right)}} \\ &= \pi h\sqrt{\frac{i}{s}\cdot\frac{E}{w}}\sqrt{1 - \frac{1}{\frac{2i}{se}\left(\frac{k}{w} - 1\right)}} \end{aligned}\right\} \quad . \quad . \quad (g)$$

From these we see that for a given load W, the permissible length increases with the section S, and in a considerable faster ratio than S itself; while for a given section S, as the load W is increased the length decreases at a rate faster than $\frac{1}{\sqrt{W}}$, but not so fast as $\frac{1}{W}$, except for such large loads as are never used in practice. L also increases as the excentricity e decreases; it is proportional to an angle whose secant is inversely proportional to e.

For each material E and k may be considered as approximately fixed; and for each shape of section $\frac{i}{s}$ is fixed. Thus, for each material and each shape of section, and each proportionate excentricity e, we might draw out a series of curves showing how the ratio $\frac{L}{h}$ varies with the average stress w; or without taking either E or k as fixed, if we take the ratio $\frac{E}{k}$ as constant for each curve, the curve may be made to represent the law of variation of $\frac{L}{h}$ with $\frac{k}{w}$. Such series of curves are given in the 1887 paper of the present writer mentioned above.

The table annexed gives sufficient ordinates to enable

Table of Values of

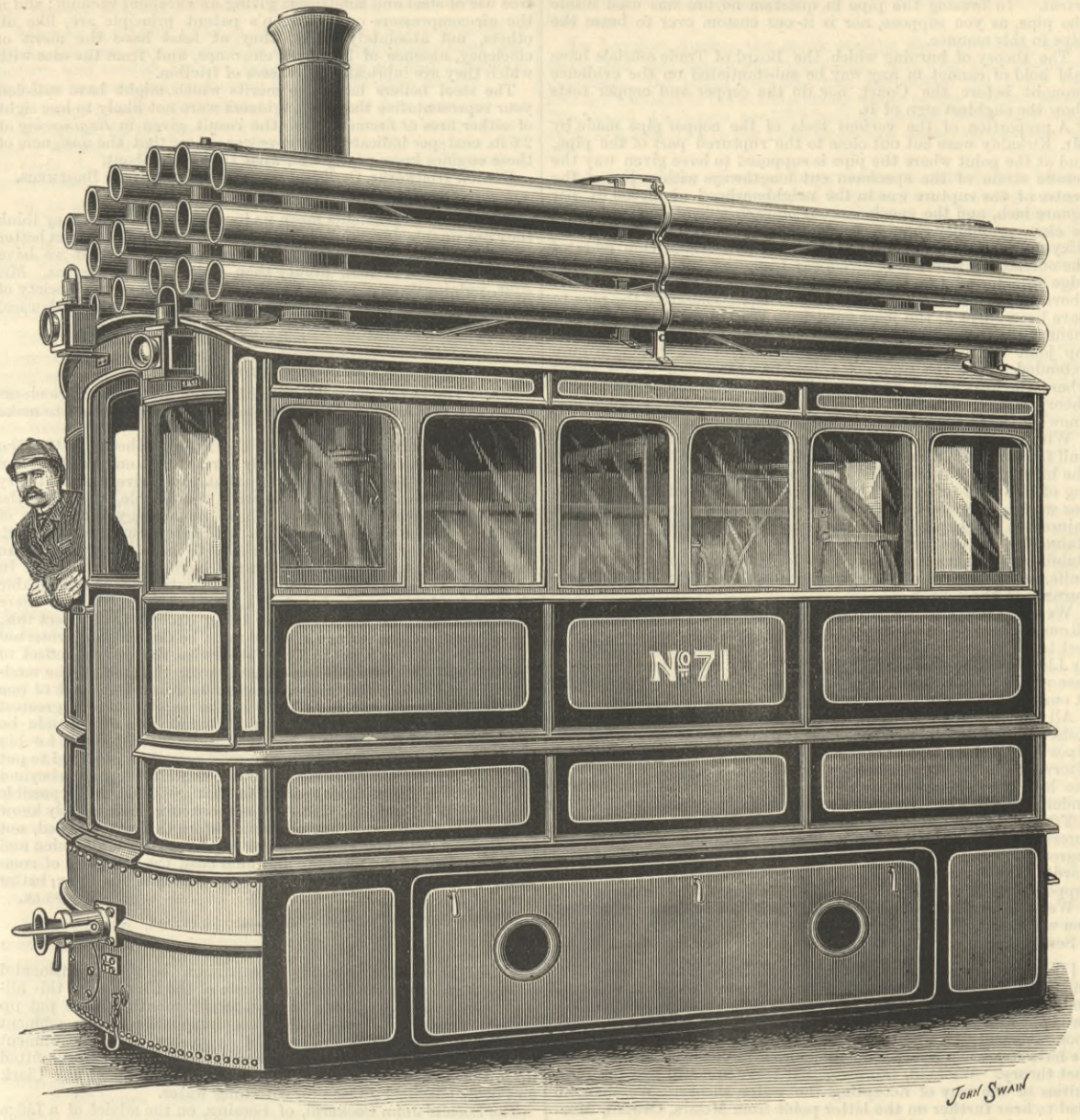
$$\frac{L}{h} = 2\sqrt{\frac{i}{s}\cdot\frac{E}{k}}\sqrt{\frac{k}{w}}\ \text{sec.}^{-1}\left\{\frac{2i}{se}\left(\frac{k}{w} - 1\right)\right\}$$

with the factor $2\sqrt{\frac{i}{s}\cdot\frac{E}{k}}$ *put equal to* 100.

$\frac{2i}{se} =$	·1	·2	·3	·4	·5	1	2	3	4	5	10	20
$\frac{w}{k}$												
·06	358											
·07	271											
·08	183	397										
·09	49											
·091	0											
·1		309	376	406	426		479	485	488	489	493	495
·15		126	243	306								
·16		77										
·167		0										
·2			131	200	234		323	336	337	340	345	348
·22			74									
·231			0									
·25				117								
·286				0								
·3					99		252	261	267	271	279	283
·32					61							
·333					0							
·4							194	213	222	227	238	243
·48												
·5							148	174	186	194	208	215
·6							93	135	153	163	183	193
·65							47					
·667							0					
·7								81	113	130	160	174
·73								50				
·75								0				
·78									55			
·8									0	72	130	153
·833										0		
·89											67	
·9												116
·909											0	
·93												87
·952												0

TRAMWAY LOCOMOTIVE, BIRMINGHAM CENTRAL TRAMWAYS.

MESSRS. C. BURRELL AND SONS, THETFORD, ENGINEERS.



one to plot a series of such curves. The formula is taken in the form

$$\frac{L}{h} = 2\sqrt{\frac{i}{s}\frac{E}{k}}\sqrt{\frac{k}{w}}\ \text{sec.}^{-1}\left\{\frac{2i}{se}\cdot\left(\frac{k}{w}-1\right)\right\}$$

The factor $2\sqrt{\frac{i}{s}\frac{E}{k}}$ can be calculated directly from the data of any special problem. It is capable of varying from about 10 to 100, and it is more often smaller than greater than 50. In calculating the table it has been taken 100 as a standard, so as to enable the curves in Figs. 1 and 2 (*vide* next published part) which correspond with the numbers in the table, to be employed generally for all data. One has simply to reduce the horizontal readings from the curve suited to each case, in the ratio that this factor according to the data of the problem is less than 100. The factor $\left(\frac{2i}{se}\right)$ is also supposed to be directly calculable from the data, the excentricity e being estimated in accordance with one's knowledge of the general arrangement of the structure and the workmanship and material. It may vary from less than $\frac{1}{10}$ to more than 20.

BURRELL'S TRAMWAY LOCOMOTIVE.

The tramway locomotive which we illustrate by the accompanying engravings deserves special attention because of the exceptional results which it has given. It is a compound engine with inside cylinders, and for the present we reserve detailed description. The most important feature about it is the condenser. This, as will be seen from our engraving, consists, not of a great number of small tubes, as usual, but of eighteen large tubes about 12ft. long. These tubes are of thin brass, and inside each is placed another ½in. less in diameter. The steam to be condensed enters the space between the two. As the engine moves a brisk current of air is set up through and around the tubes, and the steam lying in very thin sheets is rapidly and most effectually condensed. Great care has been taken in proportioning the cylinders, heating surface, &c., to get a good result.

We recently carefully watched the performance of this engine in Birmingham. The coke sheets were also courteously submitted to our inspection, and we have satisfied ourselves that the figures we give of its performance are accurately true. The engine, we may add, works on the Sparkbrook route, an incline in Bradford-street of 1 in 20, 480 yards long. On the King's Heath route there is a gradient of 1 in 18. These cannot be "rushed," as, by the Board of Trade regulations, there are stopping places at the bottoms of the inclines.

The engine first ran altogether about 400 miles on the Sparkbrook road. Then it was put on the King's Heath line, and did 348 miles. Latterly it has done 300 miles on the Smallheath line, the steepest gradient of which is 1 in 18, 640 yards long; the total mileage up to the present, 1048 miles. The actual coke consumed per mile without that required for lighting up comes to 6·4 lb. When running for fourteen hours a day on the heaviest line (Smallheath), the total average consumption comes to 8·7 lb. per mile, including lighting up, and only running forty minutes in each hour, which of course increases the amount per mile. The water consumed is 400 gallons per day, or taking a day's run of fourteen hours at eighty-four miles, this gives 4·7 gallons per mile, or 28·5 gallons per hour, on the Smallheath road. When running on the Sparkbrook road the engine can run all day without taking in fresh water, the amount used being about half. The consumption of coke is also less. These results, compared with the working of other engines on the same road, are startling, especially when we remember that some of them are burning quite twice as much fuel, and using no less than 2000 gallons of water per day. The weight of the engine, loaded, is twelve tons, and the working pressure 160 lb. It is, we think, quite unnecessary to comment on these figures. They will speak for themselves to everyone who has to do with the management of tramway locomotives.

These engines have locomotive boilers with copper fire-boxes and brass tubes. The entire shell is of Lowmoor iron, or Siemens-Martin steel; all the rivetting is done by hydraulic machinery, and the boiler is stayed for a working pressure of 180 lb. A large dome is provided on the boiler, which enables the barrel to be worked full of water, if necessary, when ascending any steep incline, and also permits a large storage of heat to be maintained. The cylinders are inside the frames. The slide valves, which are placed on the top of the cylinders, are driven by Joy's patent valve gear. The starting and reversing levers and brake levers are arranged in duplicate—one at each end of the engine—so that the driver has all the levers under his control when running either end first, and need not take his eye off the line. The driving wheels are four in number, and are 2ft. 6in. in diameter. The wheel base is 4ft. 6in. All the working gear is shut in from below by iron sheets with suitable doors; the only working parts exposed to dust are the coupling rods, and they are carefully capped over at the ends. The horn-blocks are fitted with adjustable liners for taking up wear, and have shields to exclude the dirt from the outside. By an extremely simple patent disconnecting arrangement, worked from either end of the engine, steam is admitted to the low-pressure cylinder to facilitate starting, and the smaller cylinder can also be opened to exhaust if necessary, so that this engine will start with a larger load than any non-compound engine of the same size. A very ingenious spring buffer draw bar is fitted at each end, for attachment to the passenger car, and a chain with a hook to couple up to the brake chain.

ENGINE TURNTABLES—INDIAN STATE RAILWAYS.

On page 350 we give illustrations of engine turntables for the Indian State Railways, for which contracts have recently been let. The drawings convey their own description, and it is unnecessary to repeat here the facts and figures given by them.

THE EDINBURGH CABLE TRAMWAY.

The Edinburgh Northern Cable Tramway Company has for some time had a cable tramway under construction, running north from Princes-street. Of the constructive details of this tramway we give this week some engravings, which will be followed by others, together with a general description of the tramway. The tramway is being made by the Patent Cable Tramways Corporation, from designs and under the superintendence of Mr. W. N. Colam, Assoc. M. Inst. C.E. The contractors are Messrs. Dick, Kerr, and Co., London.

LETTERS TO THE EDITOR.

[*We do not hold ourselves responsible for the opinions of our Correspondents.*]

THE THEORY OF STRUTS.

Sir,—In your current number of October 14th I am glad to see that Professor R. H. Smith is commencing a paper on the working strength of struts—a subject which certainly demands some further investigation; but as the author has incorrectly quoted some of my own deductions in connection with this matter, I trust you will allow me to correct the inadvertent mis-statement contained in his paper.

After describing the empirical methods of Hodgkinson and Gordon, and the rational but insufficient theory of Euler, he refers to the graphic investigation which I have attempted, and which was briefly described in the "Trans." Inst. C.E., 1886; and without alluding to the leading propositions advanced in my paper, he selects a particular formula which I had deduced from a particular case, and on applying it to another case—to which I had not applied it—he naturally discovers a certain discrepancy, which he wrongly attributes to some mistake in the formula, but which really arises from the fact that the two cases are not quite identical, although they are so nearly parallel that for practical purposes they may be considered together.

The formula in question occurs in the course of an argument of which the leading points are the following, viz.:—

1. Euler's theory is perfectly correct for a column fulfilling the ideal conditions—(*a*) that it is perfectly straight; (*b*) that it is perfectly homogeneous; (*c*) that it is accurately centred at the ends. But if either of these conditions is unfulfilled the theory is not true, and requires an important modification to make it true.

2. Euler's theory leads to the following conclusions, which must be true for an ideal column, but are contradicted by common experience:—(*d*) That the column cannot deflect at all under any load less than the breaking load, and when it begins to deflect it will deflect until it breaks; (*e*) that the breaking load in a long column depends solely upon the modulus of elasticity, and will be nearly the same, whether the column is made of wrought iron or of the hardest steel; (*f*) that the breaking load ought generally to be considerably greater than it is.

3. It is therefore certain that in practice the conditions *a*, *b*, and *c* are not all fulfilled, and it becomes necessary to examine the consequences of their non-fulfilment, and to see whether this would account for the observed behaviour of columns.

4. Taking first the case (*a*) of a column having a slight initial curvature, I find that the effect of imposing any given load upon the column is to produce a certain augmented deflection, which I have expressed by a formula precisely equivalent to that given by Professor Smith; and that the theoretical conclusions *d*, *e*, and *f* will in consequence be reversed and brought into harmony with the known experimental facts. But it is certainly possible to make a strut without any perceptible initial curvature, and accurately centred; and therefore the required explanation must rather be sought for in a want of homogeneity of the material.

5. Taking, therefore, the case (*b*) of a perfectly straight strut consisting of separate legs or flanges braced together, I assume that the modulus of elasticity in one leg may be greater than in the other leg, by such a difference as is commonly observed between different test bars, or between different strips cut from the same test bar; and having traced the deflection of the loaded strut, I find the results of this unequal elasticity are very similar to those above described, although not exactly identical. The formula quoted by Professor Smith is based upon this case (*b*) of unequal elasticity, and not upon the previous case (*a*) of initial curvature, to which he erroneously applies it.

6. But the important point is that an inequality of elasticity, such as is commonly observed in practice, is sufficient in itself to explain the observed behaviour of columns in every particular, and to harmonise "Euler's" theory with observed facts. The conclusions of the theory will, in fact, be modified as follows:—(*d*) The deflection of the strut will increase as the load is increased—slowly at first and very rapidly afterwards, in conformity with known facts; (*e*) the breaking load will not depend upon the modulus of elasticity alone, but also upon the ultimate compressive strength of the material; (*f*) when the ultimate strength is known, the breaking load will depend upon the inequality of modulus, and will be correspondingly reduced.

7. Taking the greatest inequality of modulus that is commonly observed, I find that the theoretical strength—as given by Euler—is reduced by an amount varying from zero to about 36 or 40 per cent., according to the proportions of length to diameter. The reduction is very little in the case of a very long or a very short column, but is greatest when the proportions are those most commonly used in practice, *i.e.*, precisely in those cases where Euler's formula gives too high a result.

8. The inequality of modulus will vary in different bars, and its amount cannot be estimated beforehand, but its probable limit can be estimated. Therefore, the strength of a column of given proportions cannot be determined by any hard-and-fast line, but it may certainly be calculated to come somewhere between two fixed limits. The strength cannot be greater than that of Euler's ideal column, and it will not be less than that of a column of maximum inequality.

9. To test the theory, I trace the curves representing the theoretical upper and lower limit, and upon the same diagram I place the actual results of all known experiments; and I find that the latter form a constellation of points whose envelope coincides with the limiting curves.

10. These diagrams are traced for cast iron, wrought iron, and hard and mild steel, and they show that one common formula is applicable to all these materials, and in each material to columns of all proportions, and in all probability is applicable to other materials also.

11. Assuming the substantial truth of the theory to be thus demonstrated, I have applied it to determine the stress in different parts of the bracing and legs of a braced strut.

12. And I have also based upon it some remarks in regard to the working strength of struts, which may conceivably be determined by applying a factor of safety either to the breaking load, the elastic limit, or the breaking stress. In the case of a short column the three methods would give the same result, but in the case of a long column they would give three different results; and I have referred to some of the reasons why the last-named method, which approximates to that recently proposed by Professor Krohn, cannot be relied upon in practice.

I am not aware that the above propositions had been advanced at any time prior to the date of my paper, but they are more fully worked out and illustrated in the work on "Bridge Construction," which is now in the press, and which contains also a further chapter relating to the practical application of theory in the design of struts, and taking into consideration not only the liability to primary flexure, but also the effects of secondary flexure or wrinkling of the component membranes, and the limits which are thus imposed upon the thinness of the members and the ratio of diameter to sectional area. But I fear I have already trespassed too much upon your valuable space. T. Claxton Fidler.

8, Delahay-street, Westminster, October 20th.

CONTINUOUS BRAKES.

Sir,—The return relating to the continuous brakes in use on the 30th June, 1887, has recently been issued by the Board of Trade, but the result must be considered as extremely unsatisfactory. Ten years after the celebration conditions were laid down by the Board of Trade, one would hardly have expected to find railway companies fitting a large amount of rolling stock with the old simple vacuum brake, nor could it have been expected that 147

vehicles would have been fitted with the dangerous two-minute leak-off brake.

The following table shows that out of a total rolling stock of 8472 engines and 52,808 vehicles, only 2688 engines and 23,729 vehicles have brakes which are even returned by the companies as fulfilling the necessary conditions for safety; and even these figures are too high, as from an examination of all the various systems which I made at the early part of this year I know that the brakes on many engines and vehicles are included which should not be:—

	Engines.	Vehicles.
Total amount of stock returned as fitted with brakes complying with conditions of Board of Trade	2,688	23,729
Total fitted with brakes which do not comply	1,570	13,733
Total fitted with continuous brakes	4,258	37,462
Total fitted with apparatus for working brakes, or with pipes and chains	3,532	8,206
Total not fitted with either brakes, apparatus, pipes, or chains	682	7,140
Total not fitted with continuous brakes	4,214	15,346
Total rolling stock, therefore	8,472	52,808

Attention should be directed to the necessity for a uniform system, and to the great extra cost of fitting rolling stock with two complete systems of continuous brake.

The following table shows that almost 1000 vehicles have been thus fitted, because companies forming continuous routes cannot, or will not, agree upon one brake:—

Railway.		Brakes.
	Engines.	
North-Eastern	12	Westinghouse automatic — Smith's vacuum.
North-Eastern	6	Westinghouse automatic — automatic vacuum.
	Vehicles.	
West Coast Joint-Stock	286	Westinghouse automatic — Webb vacuum.
London and North-Western	174	
Caledonian	47	
Midland Scotch Joint-Stock	85	Westinghouse automatic — automatic vacuum.
Midland	119	
Glasgow and South-Western	43	
East Coast Joint-Stock	125	Westinghouse automatic — Smith's vacuum.
Great Northern	2	
North-Eastern	64	
North-Eastern	13	Westinghouse automatic — Midland vacuum.
North-Eastern	22	Westinghouse automatic — L. and N.W. vacuum.
L. and Y.	2	Westinghouse automatic — automatic vacuum.
Highland	13	Automatic vacuum—Newall's
Total	995	vehicles.

On the 25th July last a train left the line at Aviemore, on the Highland Railway. The whole train was fitted with various kinds of brakes, and some of the vehicles with two kinds; yet none could be coupled up and used. The vehicles belonged to the Highland, Caledonian, West Coast, East Coast, and Midland Joint-Stock.

From the above table it will be seen that the whole of the rolling stock sent from England to Scotland by the three routes is fitted with the Westinghouse brake. Yet from the brake return it will be seen that the Highland Railway is not fitting any engines to work that brake over its system.

Well may the Government inspector report that "the interposition of carriages belonging to other companies is a state of things which will constantly occur until it is made obligatory for all passenger trains to be fitted with a continuous brake in working order." CLEMENT E. STRETTON.

27, Belvoir-street, Leicester, October 24th.

FOREIGN COMPETITION.

SIR,—In your last week's issue you have a letter headed "Foreign Competition," which is really more a tirade against Germans and German Jews than anything else, and the funny thing about it is that it bears the signature of a suspiciously Jewish-looking name. But, Sir, as your correspondent calls in question the class of men called by him German Jews, I would like to give my experience of now more than a quarter of a century of business connection with German Jews. Many years ago, when I first became manager to a firm of engineers whose speciality was just being introduced to the Continent, I made in Hamburg the acquaintance of a German Jew, who became our agent, and through him I made a further acquaintance with German Jews in Leipzig, Vienna, and several other continental towns. In later years, when in business for myself, we had as agent in Sweden a German Jew, and even in the city of Manchester, from whence your correspondent hails, our best exporting customer was a German Jew. Now, after five-and-twenty years' experience as a manufacturing engineer, dealing with and by means of German Jews, I can give as my sincere testimony that more honourable, upright, and straightforward business men could not be met with than I have experienced among German Jews. I have met in my experience with much more wrong-doing and wrong-dealing among English and Scotch traders than I ever saw or heard of among either German or any other Jews. There are bad men in all nations, but it is a silly, if not a suspicious, circumstance to see a man through the medium of your columns trying to throw mud on the reputation of a nationality which has through long generations proved its business talent by keeping its position.

I, as a Scotsman, shall always honour, as the result of my experience of their character, not only German, but all Jews.

Edinburgh, October 19th. RICHARD KERR MILLER.

A DEFECTIVE BRIDGE.

SIR,—There is a lattice girder bridge on one of the railways in South America, of four series of triangulations, and consisting of four spans of 281ft. each, and divided into twenty-four bays. The inclined bars are built to an angle of 45 deg. The effective height of the bridge is 25ft., and the struts and ties cross each other at distances apart of about 8ft., and in this intervening space of 8ft. the ties are buckled in some places as much as 3in. out of line. Some places are buckled in and other places buckled out, so that the bars present the appearance of a series of ridges and furrows or else serpentine curves. In each span fully 60 per cent. of the bars are buckled from 1in. to 3in. in the short space of 8ft. Towards the abutments, where the tie-bars are thicker, there is no buckling, but towards and at the centre the tie-bars give the appearance as if the girder was about to topple over. The struts at the centre are also buckled, but this can readily be accounted for, from causes which need not be mentioned here. All the ties were made counterparts of each other. The bridge was built by a well-known Scotch firm, and was fitted up in the workshops, inspected and approved by the consulting engineer. Can any of your readers say (1) the cause of the buckling; (2) the remedy? The sizes of the buckled bars vary from 9in. × $\frac{3}{8}$in. to 9in. × $\frac{5}{16}$in. INQUIRER.

October 24th.

THE ELBE'S STEAM PIPE.

SIR,—We notice in your impression of the 21st inst. you have an article on the Elbe explosion. We think your remarks in regard to same have been made without any knowledge of the evidence given at the inquiry held on the 28th and 29th ult., previous to the adjourned inquiry.

At the previous inquiry, on 28th and 29th ult., most exhaustive evidence was given as to the mode of brazing and making the burst pipe, and to show that it could not possibly have been burnt. In brazing the pipe in question no fire was used inside the pipe, as you suppose, nor is it our custom ever to braze the pipe in this manner.

The theory of burning which the Board of Trade officials have laid hold of cannot in any way be substantiated on the evidence brought before the Court, nor do the copper and copper tests show the slightest sign of it.

A proportion of the various tests of the copper pipe made by Mr. Kirkaldy were cut out close to the ruptured part of the pipe, and at the point where the pipe is supposed to have given way the tensile strain of the specimen cut lengthways within $\frac{1}{4}$in. of the centre of the rupture was in the neighbourhood of 31,000 lb. per square inch, and the specimens cut on each side of the rupture in as close proximity show a very high breaking strain, and are of silky appearance. Further, a small portion of the thin edge of the outside lap where it is torn away from the spelter has its thin edge intact, and the pipe gave way in the solid copper outside above lap, and not below inner edge of lap. Therefore the pipe to have been burnt at the joint must have been burnt in such a clever manner through a length of about 3ft. that the thin edge of the lap joint was not fused, and this burning of 3ft. in length only extended across the pipe some $\frac{1}{4}$in. in width, and it was burnt where the heat would be least. We hold that the burnt copper theory is an impossibility, and any one competent to judge and knowing the facts will come to the same conclusion.

With regard to the sketch you give of the pipe showing a dark, dull fracture with a line of silky, bright fracture, this pipe was not the burst pipe, but one adjoining it at the fore end, and the bursting of this pipe referred to took place under hydraulic pressure at our works. The dark fracture is owing to the pipe having been injured at the explosion by the force of the water ram, and so stained by the coating on the pipe in the cooling process. This staining was on the surface, and could be scraped off with a penknife, and below the surface there was not the slightest sign of any burning of the copper.

We may state that for years past we have made a rule of testing all our copper steam connections, valve boxes, and other parts subject to steam pressure in our steamers, although not required either by Lloyd's or the Board of Trade, nor do we remember any single case where a representative of either of these bodies was present at our tests previous to the Elbe explosion.

All the Elbe's pipes, valves, &c., were subjected to hydraulic tests, the pipe in question that gave way, and her other main steam pipes were tested, first of all by us to 300 lb. per square inch, and afterwards in the presence of the Royal Mail Company's inspector, the late Mr. Thompson, to 350 lb. per square inch; and when under pressure were minutely examined, and passed as perfect.

You will, therefore, see that every care possible for manufacturers to take has been taken by us in making these pipes, and we regret the untenable burnt copper theory has been brought forward by the Board of Trade officials, without a tittle of proof in support of such a theory.

We trust as you have given such prominence to the Elbe matter you will insert this letter. OSWALD, MORDAUNNT, AND CO.

Southampton, October 26th.

[We are in possession of all that was adduced at the first inquiry, and we have been careful to show that Messrs. Oswald, Mordaunt, and Co., left nothing undone to secure good workmanship. We have put forward the burning theory as a theory, and if our correspondents will turn again to what we have said, they will find that we have expressly referred to difficulties in the way of accepting that theory. We hold, however, that there are still greater difficulties in the way of accepting the water theory. We shall be glad to hear further on the latter point from Messrs. Oswald, Mordaunt, and Co.—ED. E.]

ANCHOR TESTS.

SIR,—The report of the Committee's proceedings and recommendations of tests to be applied to cast steel anchors, contained in your issue of the 14th inst., merits some attention, which, I think, must be apparent to all who have given the subject any consideration, especially when we are informed that Mr. Thomas Trail, the chief engineering surveyor of the Board of Trade, who was one of the committee appointed, could not agree with his colleagues' report.

Why did the Committee not visit other eminent steel foundries where steel castings are produced for anchors of the most modern and improved type? Had they done so they would have been most courageous indeed to have recommended the percussive or drop test as at present expressed. They would also have seen steel anchor castings proper, not such as illustrated in their report, viz., cast first, then forged, and afterwards drop tested, as in the case of the shank referred to in their report. This is not a steel casting as ordinarily understood. I may be wrong, but what do your readers think of this single instance of the effect of the report upon makers of steel anchors other than the one manufactured at Messrs. Spencer and Sons' works?—and it is only one of the many points that will be brought before the Legislature when the time arrives.

A. and B. are makers of cast steel anchors and they each receive an order for an anchor of 30 cwt. finished, but of different designs, A.'s anchor is constructed in three parts of 10 cwt. each, each of these parts is drop tested separately through a distance of 15ft. on to an iron slab, which means expressed in foot-cwts., $15 \times 10 = 150$ foot-cwts. To this I do not object, provided it be made the accepted data for drop tests on all cast steel parts of anchors. But mark the effect on B.'s anchor of another design and constructed in two parts, one 20 cwt. and the other 10 cwt. The 20 cwt. piece, according to the recommendation of the Committee, must be dropped through a distance of 12ft. on to an iron slab, this expressed in foot-cwts. means, $20 \times 12 = 240$ foot-cwt.

Now, Mr. Editor, is there any substantial reason why this piece of B.'s anchor should be subjected to nearly double the test of any portion of A's anchor, simply because of structural formation, especially when we know that both anchors, when finished, are to sustain the same statutory test and to be supplied to vessels of the same register tonnage and the same size of cables to be attached to the anchors when in use?

My impression is that B is a victim. If a drop test be imperative, let it be expressed in foot-pounds, and let the slab on which the anchor is to be dropped be properly specified; do not leave it to the inspector to say. One man may be content with an iron slab 1in. thick which will bend and not break with the blow; another may want a slab 1ft. thick, which will neither break nor bend with the blow, and the difference of the effect under the different conditions is well enough understood and does not require any comment from me. I may add, in conclusion, that it would be interesting to witness the effect of this drop test upon the majority of wrought iron anchors with welded arms. I fancy there would be a host of cripples. JUSTICIA.

October 26th.

HENLEY-ON-THAMES SEWAGE WORKS MACHINERY.

SIR,—The statement of your representative, by which the makers of this machinery are made to confess to shortcomings and promise better things in future, is too striking to be passed over without the direct denial that any such conversation or admission ever took place.

To ourselves the report is of little consequence, as we may safely leave the workmanship to take care of itself, but loyalty to Messrs. Shone and Ault, to whose careful and well-considered designs these engines were constructed, compels us to make this denial, and to state the impossibility of our having imputed antiquity as a characteristic of engines which, short of triple expansion and 150 lb. pressure, are fully up to the newest and best types of well constructed compound condensing engines, they having accurately proportioned variable expansion, automatic regulation, steam jacketted covers as well as cylinders, complete clothing, and lagging, large bearings, free use of steel and condensers giving an excellent vacuum; and if the air-compressors on Sturgeon's patent principle are, like all others, not absolutely silent, they at least have the merit of efficiency, absence of loss from clearance, and, from the ease with which they are lubricated, no excess of friction.

The steel boilers have also merits which might have satisfied your representative that the engineers were not likely to lose sight of either fires or firemen; and the result given in *Engineering* at 2·61b. coal per indicated horse-power shows that the designers of these engines knew pretty well what they were about.

Denton Ironworks, Carlisle, October 26th. PRATCHITT BROTHERS.

[Do our correspondents mean us to understand that they think they are unable now, and always will be unable, to construct better machinery than that at Henley? If so we may say that we have more confidence in their ability than they have themselves. Mr. Ault, judging from a paper which he read before the Society of Engineers, seems to have arrived at conclusions practically identical with those of our representative.—ED. E.]

THE RIBBLE SCHEME.

SIR,—You have kindly intimated a willingness to receive observations on this scheme. I avail myself of the opportunity to make a few general remarks.

It has been often asserted that the Ribble scheme is like the river improvements so successfully carried out on the Tees, the Tyne, and the Clyde. I beg to say that these rivers present very material differences as compared with the Ribble, and that the works of improvement carried out have no analogy in the case of Preston. If the Ribble promoters will carry out their training works to the bar, then they may claim to have accomplished an end, but at present they are but at the beginning of the end. In a nutshell, the unsolved problem is the maintenance of a navigable channel for large vessels between Lytham and the bar, and there is no assurance that the works now being executed will effect this.

The mouth of the trained channel must be defined and protected as it is on the Tees and the Tyne, otherwise the scouring effect of the ebb will be lost by being diffused over the area of the sand-banks, and half a dozen minor channels be formed instead of one main channel. As surely as York is the capital of our greatest county so surely will further works of immense magnitude be required before the Ribble becomes a safe place of traffic for big steamers, and the people of Preston may as well be prepared to put their hands into their pockets for another half million pounds beyond the present application for more than that amount. As to possible income? As an engineer that does not concern one. I only know that it is not safe to count chickens before they are hatched, not to prophesy until you know. Were I pressed for an opinion and having regard to the ultimate and final cost, the prospects of competitive business, and other points, I should say it won't pay, better have let it alone. ENGINEER.

Blackburn, October 26th.

WATER SOFTENING.

SIR,—There is a striking comparison between continental chemists and their *confrères* on this side of the Channel on this all-important subject. Within the last twelve months I have put up sixteen apparatus through the recommendation of an eminent Parisian chemist. The professor of chemistry in a Government industrial college in the north of France had my apparatus fitted up in the college to show to the students the merits of the Clark and other chemical process for softening water.

The Société John Cockerill, of Seraing, on the advice of a Liége chemist, put up my apparatus, and their report has just come into my hands, where I find the following:—"The water (river Meuse), before softening, is 18 deg., and is reduced by your apparatus to 4 or 5 deg."

The Gas Company of Rome, under the advice of a chemist, put up a trial apparatus, and their report says:—"The Mercia water, having 18 deg. of hardness, is reduced to 3 deg., the softened water is absolutely clear and limpid."

Satisfied with this result, and so important do they consider this question, that they have ordered from me apparatus to soften 144,000 gallons per day.

If, then, we engineers are wrong, we are at least backed up by the most eminent chemists in France, Belgium, Italy, and Spain.

ANDREW HOWATSON.

Cronberry, Belle Vue-road, Upper Tooting, Oct. 25th.

THE CLARK PROCESS.

SIR,—We observe in the second line of the interesting article in your issue of the 21st inst. that you refer to the above as if it were peculiar to the Porter-Clark machine, and we think it well to point out that the Clark process is only used with this apparatus in the same way as with the "Howatson."

We mention this simply to identify the Clark process as common to both, the difference lying in the machine and mode of treatment, and we think that the issue in question will be better defined if this be made clear. Probably the apathy hitherto shown to a more extensive treatment of various waters may have arisen from the costly apparatus required, together with the large space occupied, both of which obstacles may now be considered to have been overcome. J. W. GRAY AND SON.

115, Leadenhall-street, E.C., October 26th.

GERMAN CYCLES.

SIR,—The London correspondent of the leading Scottish daily writes that the Germans have established several manufactories of bicycles and tricycles, and threaten serious competition with our British makers. Will you or any of your readers say to what extent, and in what directions, our system of rewarding inventive talent and perseverance contributes, or has been perverted, to unfairly favour foreign rivalry in this new and growing business, by subjecting our operations to fees to patentees and restrictions from use of improvements, and how in actual circumstances this evil, if it exist to a large extent—as I fear it does—is to be mitigated, if not neutralised?

HON. LIFE DIRECTOR OF AN ENGLISH CHAMBER OF COMMERCE.

Oct. 25th.

FREE-TRADE AND NO TRADE.

SIR,—Mr. Muir's letter might be taken as a conclusive answer to "Trader," if it were true. Your correspondent has unwarily brought out old stock arguments with which every student of political economy is conversant. My contention is that the silk gowns to which he refers are not bought with our coal, but with something else, if they are bought at all. I have, however, no intention of entering into a controversy in your pages. I only write to say that begging the whole question in the way your correspondent of last week does, helps not at all to settle the questions at issue. The head and front of our contention is that no such transactions in silk and coal take place. PROTECTIONIST.

Liverpool, Oct. 26th.

AUTOMATIC CUT-OFF VALVE GEAR OF STEAM ENGINES.—A correspondent asks for the title of a book on this subject, and the name of the publisher. We believe a book specially dealing with these gears, or a *brochure* on this subject, was published a few years ago.

RAILWAY MATTERS.

The temporary bridge across the Amou Darya, at Charjui, will be finished in December. The construction of the permanent bridge has been commenced. The opening of the railway through Bokhara is fixed for the end of May next year.

Messrs. Neilson and Co., of the Hyde Park Locomotive Works, Glasgow, have received an order to supply thirty large locomotives and tenders for the Bengal Nagpur Railway Company. This firm has now sixty engines in hand for the same railway.

A commission of Russian engineers has arrived at Vladivostock, for the purpose of surveying the route of a proposed line of railway in the Southern Usuri region. The commission is to begin its labours simultaneously at Vladivostock, Nicoloskoi, and Boussa.

It is stated that, owing to the unpromising prospect of unremunerative traffic on the proposed narrow gauge railway between Hyderabad and Pachbadra, to connect with the Rajputana and Bombay and Baroda systems, the Indian Government has declined to sanction a survey of the route to be followed by the proposed line. It has, however, suggested the practicability of a feeder line from the Indus Valley to Mirpur.

The Public Works Committee of the Birmingham Corporation have requested the Birmingham Central, the Birmingham and Midland, and the Birmingham and Aston Steam Tramways Companies to adopt the appliance patented by Mr. Joseph Smith. The protector in question came through the various trials that have taken place with the best record. The companies are said to be taking steps to have life-protectors fixed forthwith.

Once more it is reported that a scheme has been prepared by the engineers of the Midland Railway Company for an extension of their passenger accommodation in Wolverhampton. That scheme, it is claimed, has been placed before the directors for consideration. The chief proposal is to extend the line into the centre of the town, where will be erected a commodious station. It is only natural to expect that any such scheme would meet with strenuous opposition from the London and North-Western and Great Western Companies.

The *Bulletin du Ministère des Travaux Publics* states that the German railways in 1886 had a total length of 23,145 miles, and of this 20,225 miles belong to the State, while companies' lines worked by the State had a length of 288 miles. These 20,225 miles were distributed as follows among the various States comprising the German Union:—Alsace-Lorraine, 810 miles; Prussia, 13,180; Bavaria, 2780; Saxony, 1271; Wurtemburg, 959; Baden, 803; and other States, 422 miles. The capital cost in the same year amounted to £486,120,000, while the rolling stock consisted of 12,450 locomotives, 22,735 passenger carriages, and 250,313 goods carriages. During the year 1885-86, 275 millions of passengers, and 149 million tons of goods were carried. Thus each passenger travelled an average distance of 18 miles, and each ton of goods 66 miles. The gross receipts amounted to £49,720,000, and the working expenses to £28,040,000.

The Société de Wagons-Lits has just made arrangements for running a direct train from Paris to Lisbon, the Southern Express. The first train left the Gare d'Orléans on Friday last, and was to reach Lisbon in forty-five hours. It will cross Spain by Madrid, Granada, and Seville. The Southern Express, like the Oriental Express, with which it will be in communication, will be composed only of bed-wagons, a wagon restaurant, and wagon saloon. It will only stop at a few of the chief towns on the route. Two expresses will convey travellers from Lisbon to Constantinople through France, Germany, Austria-Hungary, Roumania, and Bulgaria in 130 hours. Last Friday's train to Lisbon took with it forty persons, who had received invitations, including diplomatists, engineers, directors of railways and industrial companies, representatives of the press, and some of the higher officials connected with international postal arrangements.

The proprietors of naphtha works at Baku anticipate great results both from the construction of a tunnel, which will overcome the difficulties of the steep Suram Pass of the Caucasus, and the laying of conduit pipes from the station of Mikhailofska to Kviril, a distance of 80 versts. The existing means of transport of the Trans-Caucasian Railway are entirely inadequate in view of the demands made on it, in consequence of which petroleum loaded in cistern wagons at Baku ready for transport costs 70 per cent. more than its value in the stores. To give an idea of the development of the petroleum traffic over the Trans-Caucasian Railway it may be stated that in 1882 there were transported 3,100,000 poods; in 1884, 5,700,000 poods; in 1885, 9,100,000 poods; in 1886, 15,800,000 poods; and during the present year the figure will probably reach 18,000,000 or 19,000,000. The oil is shipped abroad in wooden and tin vessels, which are manufactured at Batoum at the works recently purchased by Baron Rothschild. These works turn out during the year sufficient vessels to contain over 5,000,000 poods. The cost of packing the petroleum is 42 copecks per pood, or slightly over the value of the oil itself.

The New York correspondent of the *Standard* telegraphing on Monday night says:—"Mr. Barker's Chinese agent, Simon Stern, has brought a duplicate of the Viceroy Li Hung Chang's map of the railway under Mitkiewicz's Concession. The route from Pekin to Shanghai is *viâ* the Grand Canal. It then follows the Yang-Tsze-Kiang River, and reaches Canton *viâ* the valley of the Pe Kiang River, its length being about 3000 miles. Mr. Barker and Makiet Chang, representing the Viceroy, signed and exchanged the ratifications of the Concession on October 12th. It is considered significant that neither the Viceroy nor Barker has authorised any of the various reports about dissension, deceit, the withdrawal of the Concession, &c. These are attributed to mercantile and national jealousies. It is expected that France will support the English opposition, and that Germany and Russia will support Barker's scheme. The first expression of any change of purpose on the part of the Viceroy would be signified to the Chinese Minister and Makiet Chang, but both are proceeding with the matter." We have reason for believing but little in the reported concessions which are said to have been granted, and that no arrangements have been or will be made with any other than native Chinese companies.

In reporting upon the causes of an accident which occurred on the 25th of July, at Aviemore station on the Highland Railway, when, as the 3 p.m. up train from Inverness—consisting of two engines and tenders, two fish wagons, luggage van, West Coast composite, Midland bogie composite, East Coast composite, Caledonian Railway third carriage, brake van, one Highland Railway third-class, one Highland Railway bogie composite, and two Highland Railway third-class carriages, and rear brake van—was entering the loop at Aviemore station at 4.58 p.m., the whole of the train, with the exception of the leading engine and tender, left the rails, Major Marindin says:—"The marks found upon the permanent way and the wheels prove conclusively that the fixed point of the crossing was struck violently by the right leading wheel of the second engine, this wheel then mounting the crossing, running along it for about 20ft., and then dropping off outside the right rail, the corresponding left wheel dropping into the 4ft. way as soon as it was clear of the check rail of the crossing. . . . . Although it has no particular bearing upon this accident, it should be noted that, with the engine and all the vehicles in the train belonging to the Highland Railway Company fitted with the continuous brake which they have adopted, this brake was not in working order, because of the interposition of carriages belonging to other companies, a state of things which will constantly occur until it is made obligatory for all passenger trains to be fitted with a continuous brake in working order."

NOTES AND MEMORANDA.

The deaths registered for the week ending Saturday, October 15th, in twenty-eight great towns of England and Wales corresponded to an annual rate of 17·8 per 1000 of their aggregate population, which is estimated at 9,244,099 persons in the middle of this year.

In London, during the week ending the 15th inst., 2358 births and 1351 deaths were registered. Allowing for increase of population, the births were 355, and the deaths 169, below the average numbers in the corresponding weeks of the last ten years. The annual death-rate per 1000 from all causes, which had been 14·4, 15·4, and 15·7 in the three preceding weeks, further rose to 16·7.

In the course of some improvements which are being carried out in the market-place at Mayence, some masonry belonging to the old Roman times was laid bare, and in it a very well preserved legionary monumental stone, bearing the inscription, "Leg XIIII G.E.M." This stone was nearly 22in. long by nearly 12in. broad. Quite near it was a Roman fireplace with the ashes still *in situ*. The chimney, also well preserved, was made of earthenware pipes, which fitted exactly into one another.

In a recent number of the *Comptes Rendus* a memoir on the syphon barometer was presented by M. Govi, who credits Torricelli with the first idea, and Pascal with the practical execution and first employment of this instrument, the invention of which has been successively attributed to Robert Hooke, Robert Boyle, and Borelli. He shows that the principle was known to Torricelli in 1644, when he used it to explain to Ricci the theory of the cistern barometer; also that Pascal was acquainted with it in 1653, while Hooke mentions it for the first time in 1665, Boyle in 1666, and Borelli in 1667.

A process of obtaining aluminium from its ores or from aluminiferous earths, or earths containing alumina, and of combining aluminium with other metals, is described in a patent specification of W. A. Baldwin. A mixture of 4 parts of clay, 1 part of charcoal, and 3 parts of sodium chloride fused in a suitable pot yields a light alloy of aluminium and sodium, to be skimmed off and re-melted in a fresh crucible under a cover of sodium or sodium chloride. When melted, the contents of the second vessel are poured into a heated mould, wherein the heavier aluminium subsides. Or by introducing other metals, useful alloys are formed without fusion, by the simple permeation of the alloying metal by the aluminium.

A new way of utilising dynamite has been lately devised by a French military engineer, M. Bonnetond. As described in *Nature*, he uses the expansive force to drive out, for a brief period, the water from portions of wet ground in which foundations are to be made. The method is now in practice in the construction of a fortified *enceinte* at Lyons. A hole is first bored 10ft. or 12ft. deep, and about 1½in. wide, in the wet ground. Into this is passed a string of cartridges of dynamite, which is then exploded. The water is thus driven far out beyond the sides of the cavity, over a yard wide, which is produced, and it does not reappear till after half an hour at least. The workmen thus have time to clear the cavity and introduce quickly-setting concrete. When the water returns it cannot injure the foundation. A rapid rate of progress is realised by this method.

A paper on "The Atomic Weight of Gold" was read at the recent British Association meeting by Dr. J. W. Mallet, F.R.S. Attention is called to the importance of correct determinations of atomic weights by different experimenters, and especially the elimination of "constant errors." Considering the desirability that all such values should be connected as directly as possible with hydrogen, a method is described by which this may be done in the case of gold. A known weight of zinc is dissolved in dilute sulphuric acid, and the hydrogen evolved is measured. A solution of bromide or chloride of gold is then treated with zinc more than sufficient to precipitate the whole of the gold, the residual zinc being determined by the hydrogen evolved on treatment with sulphuric acid. The difference in volume of hydrogen obtained gives a direct means of calculating the atomic weight of gold. The author described various experimental precautions that had been taken in measuring the gas.

The atomic weight of zirconium has been recently determined by Dr. G. H. Bailey. The previous determinations of the atomic weight of this element were made by Berzelius (89·25), Hermann (88·8), Marignac (90·54). The earlier results were doubtless vitiated by the presence of iron and of the cerite earths, whilst Marignac's determination is open to objection from the character of the salt—potassium zirconium fluoride—which he used. In the present determination zirconia was prepared from North Carolina zircons by three independent methods. It was dissolved in sulphuric acid, and the sulphate was crystallised out. This salt becomes normal and constant in weight by heating some hours at 400 deg., the temperature at which it begins to decompose being 470 deg. The relation of zirconium sulphate to zirconia gives a ratio from which the atomic weight is calculated, and, though the work is not complete enough to state the result with accuracy, the value obtained agrees more nearly with that of Marignac. The author proposes to make further determinations, using the tetrabromide.

There is something very assuring about an absolute unit, such, for instance, as the metre or some of the other absolutes which somehow have a way of acquiring the appellation arbitrary in after years. "The Final Value of the B.A. Unit of Electrical Resistance as determined by the American Committee," for instance, was the subject of a paper at the recent British Association meeting by Prof. H. A. Rowland. His determination in 1876 gave 1 B.A. unit = ·9878 ohm. For his present determination the apparatus was on a very large scale. He employed both the Kirchoff and the Lorenz method. By the former method he got a final value of ·98646 ± 40, by the latter a value of ·9864 ± 18; so that the latter method has a probable error of less than a half that of the former. His value for the resistance of 100 cubic centimetres of mercury came out ·95349 B.A. units. Lord Rayleigh said that the results showed that the absolute determination of the B.A. unit by various experiments agreed much better than the comparison with the mercury standard. This was exactly the opposite of what he would have expected. There is something funny in this unexpected agreement in the determination of the absolute.

According to the Bureau of Statistics in Berlin four-fifths of the engines now working in the world have been constructed during the last twenty-five years. France owns 49,590 stationary or locomotive boilers, 7000 locomotives, and 1850 boats' boilers; Germany has 59,000 boilers, 10,000 locomotives, and 1700 ships' boilers; Austria, 12,000 boilers and 2800 locomotives. The force equivalent to the working steam engines represents—in the United States 7,500,000-horse power, in England 7,000,000-horse power, in Germany 4,500,000, in France 3,000,000, and in Austria 1,500,000. In these figures the motive power of the locomotives is not included, whose number in all the world amounts to 105,000, representing a total of 3,000,000-horse power. Adding this amount to the other powers we obtain the total of 46,000,000-horse power. A steam horse-power is about equal in some work to three actual horses' power, if we take into account the continuous working of an engine and the short turn work of a horse; and a living horse is equal to seven men. The steam engines of the world represent therefore appromimately the work of 1,000,000,000 men, or more than double the working population of the earth, whose total population amounts to 1,455,923,000 inhabitants. Steam has accordingly trebled man's working power, enabling him to economise his physical strength while attending to his intellectual development.

MISCELLANEA.

At the Charkoff Exhibition Messrs. Ransomes, Sims, and Jefferies have received the highest award, viz., gold medal.

A battery of six steam boilers in the Lawrence Ironworks at Ironton, Ohio, exploded on Monday, killing four men and injuring twenty others.

Mr. J. H. Cundall, who was the electrical engineer for the whole of the electric lighting in the Colonial and Indian Exhibition, announces change of address to offices at 121, Cannon-street, London.

The formation of Condy's White Lead Company is announced, with a capital of £200,000 in £5 shares, for acquiring the patents and carrying on the business of white lead manufacturers under Condy's patents, of which H. J. B. and H. B. Condy, the inventor of Condy's fluid, are the vendors. The new process produces perfectly white lead in about seven days, instead of about four months.

The Great Eastern steamer was offered for sale by auction in Liverpool last week by Messrs. Kellock and Co. The attendance was large, and the bidding brisk. The first bid was £15,000, which speedily mounted by £1000 to £21,000, at which figure the vessel was knocked down to Mr. Craik, manager to the late owner, Mr. Worsley, of Manchester, who gave £26,000 for the vessel twelve months ago. The sale was by order of the mortgagees.

Orders have been issued from the War-office for the appointment of a Committee to report upon the present system of technical education amongst officers of the Army, and to make suggestions as to reforms in the present course of instruction, with a view to making the education of the young officer more practically complete. The Committee, which is expected to meet shortly, is under the presidency of General H. A. Smyth, Royal Artillery.

The District Miners' Association have been considering the proposal of the recent national conference at Edinburgh—which was attended by English, Welsh, and Scotch delegates—that a scheme of restriction of output, based on an eight hours' day and a five days' week, together with a complete week's holiday, be adopted with the object of improving prices and leading to an advance in wages. The proposal has met with general approval, and will no doubt be acted upon if the miners of England and Wales are found prepared to join in the movement.

The jury engaged upon the inquiry into the cause of the deaths at Whiteley's recent fire, returned a verdict, with several riders, one of which was—"That the serious danger which may result from unscientific construction, where ironwork is largely used, calls for immediate attention, with a view to such an amendment of the Building Act as will secure the requisite supervision." It may be added to this that engineering skill, if used in conjunction with that of the architect, would avoid these dangers, and inquiry of the kind proposed would do good by directing this fireproof constructive work into proper hands.

The syllabus of the Textile Society of Yorkshire College for session 1887 includes papers as follows:—October 25th—"Colour and its Application to Textile Fabrics," A. F. Barker; "Carbonising," A. Jessop. November 15th—"The Commercial Aspect of Textile Designs," J. W. Crawshaw. December 13th—Debate on "Which is more Serviceable, Woollen or Worsted Cloth?" Woollen, C. H. Talbot; Worsted, A. E. Jones. January 17th, 1888—President's Address. February 7th—Short papers. February 28th—"Mill Engines," B. H. Thwaite, F.C.S., &c. March 20th—"The Sateen Arrangement in Textile Fabrics," G. Washington.

An interesting case of iron specimens has just been received at the Mason College, Birmingham. It was forwarded by Mr. Keep, superintendent of the Michigan Stove Company, Detroit, U.S.A., and is intended to illustrate the varieties of pig iron produced or used in the neighbourhood of Chicago, and some details of American foundry practice. The collection includes several examples of iron manufactured from the celebrated Lake Superior ore and charcoal, irons made with anthracite, and also metal made with bituminous coal and coke. There are several examples of silicious irons or softeners, which have recently come into much more general use in the States.

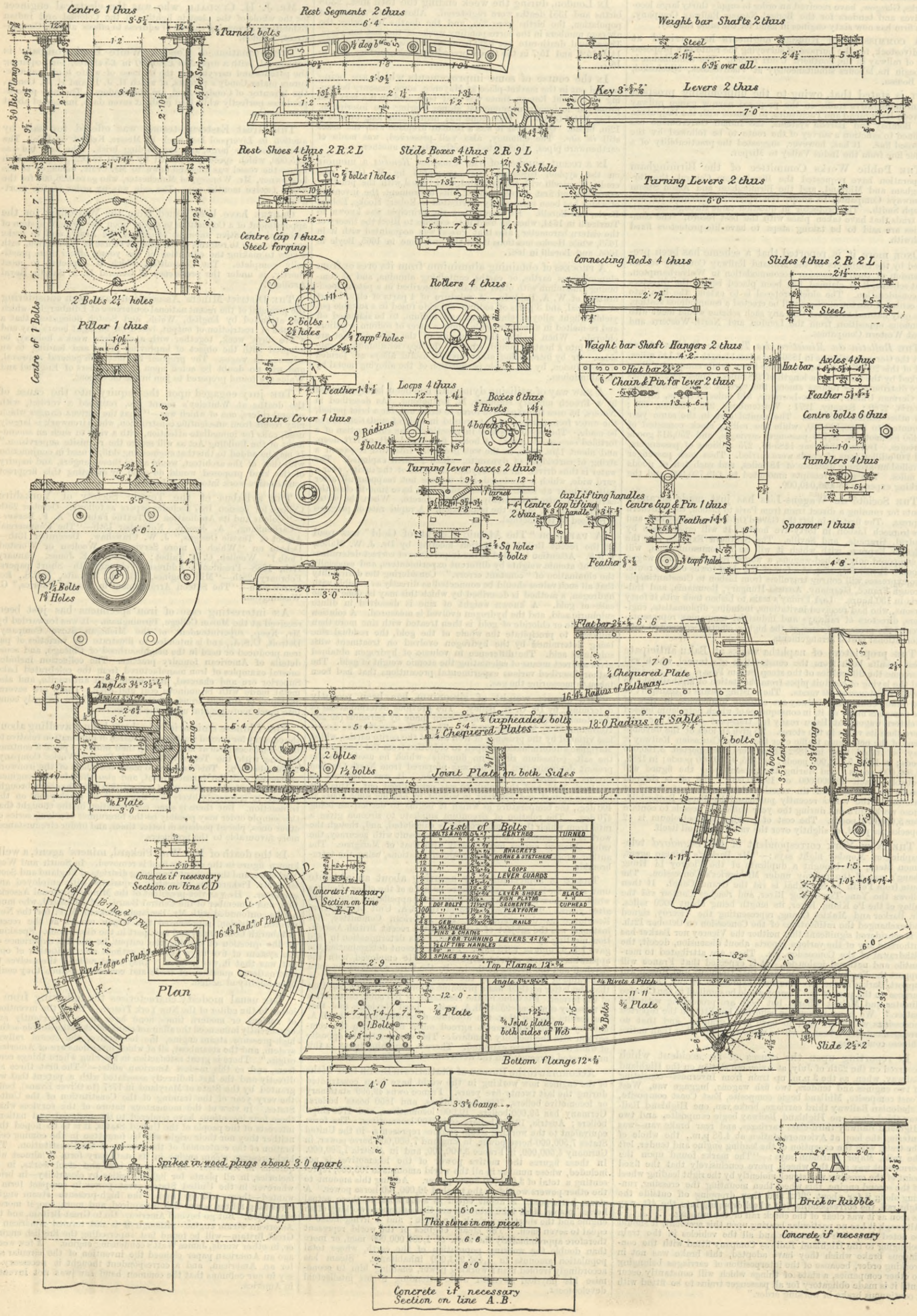
The Chinese emissaries who have been travelling about the country for several weeks past in search of information relative to blast furnaces have at last made up their minds to place a contract for one with the Tees-side Iron and Engine Works Company, Middlesbrough. This firm are to make the whole of the ironwork connected with the furnace plant, and also the blowing engines. Considering the large amount of competition which has been brought to bear, it is scarcely likely that there will be much profit on the transaction. But there is some compensation in the thought that this sample order may possibly be the forerunner of a long series of other ones, placed perhaps in better times, and under circumstances more favourable to the producers.

In the death of Mr. Wm. Pickard, miners' agent, a well-known figure in the colliery field is removed. In South and West Yorkshire, and throughout the mining districts of England and Scotland, Mr. Pickard was intimately acquainted with employed and employer. He was vice-president of the Miners' National Association, and a member of the Central Board. Mr. Pickard, who must not be confounded with Mr. Benjamin Pickard, M.P. for the Normanton Division, represented the Wigan miners at the recent Edinburgh Conference, and took part in the discussions. Speaking on the question of limiting the output, he said his experience of the system of five days per week without any limitation of output was that it was a farce. They must address themselves to international questions of trade and commerce before they could have solidity of action.

The usual modesty characterises the following from a letter to the editor of the New York *Times*:—"Of all the inventions of ancient or modern times, none have more importantly and beneficently influenced the affairs of mankind than the double-acting high-pressure steam engine, the locomotive, the steam railway system, and the steamboat, all of which inventions are of American origin." There is great satisfaction in knowing where things come from, and so this modest American adds:—"The first three are directly and the last indirectly associated with a patent that was granted by the State of Maryland in 1787 (to Oliver Evans), being the very year of the framing of the Constitution of the United States. In view of the momentous nature of the services which these four inventions have rendered to the material and national interests of the people of the United States, it is to be hoped that neither they nor their origin will be forgotten in the coming celebration of the centennial of the framing of the Constitution. The high-pressure steam engine in its stationary form is almost ubiquitous in America. In all great iron and steel works, in all factories, in all plants for lighting cities by electricity—in brief, wherever in the United States great power in compact form is wanted—there will be found the high-pressure steam engine furnishing all the power that is required, and more, too, if more is demanded. But go beyond America. Go to Great Britain, and the American steam engine—although it is not termed American in Great Britain—will be found fast superseding the English engine, or, in other words, James Watt's condensing engine." A few weeks ago an American paper claimed the invention of the circular saw for an American, and a correspondent thought it necessary to say in our columns that the common hand saw was not invented in America.

ENGINE TURNTABLES.—INDIAN STATE RAILWAYS.

(For description see page 347.)



List of Bolts			
2	BOLTS & NUTS	5 × ⅞	CENTRES
6	" "	7 × ⅞	"
6	" "	6 × ⅞	"
4	" "	⅞ × ⅞	BRACKETS
32	" "	⅝ × ⅝	HORNS & STRETCHERS
12	" "	⅝ × ⅝	" "
12	" "	⅝ × ⅝	LOOPS
2	" "	⅜ × ⅜	LEVER GUARDS
2	" "	⅜ × ⅜	" "
6	" "	12 × ⅝	CAP
6	" "	⅝ × ⅝	LEVER SHOES
88	" "	⅝ × ⅝	FISH PLATES
8	DOG BOLTS	11½ × 1½	SEGMENTS
100	" "	1½ × ½	PLATFORM
6	" "	⅞ × ½	"
48	CSK	⅝ × ⅝	RAILS
8	½ WASHERS		
2	PINS & CHAINS		
2	FOR TURNING LEVERS	4 × 1⅛	
2	¾ LIFTING HANBLES		
2	⅝ "		
88	SPIKES	4 × ½	

CUPHEAD
BLACK
TURNED

boiler should have borne three or four times the ordinary working pressure. It was difficult to believe that the boiler could have gone to any pressure which could have accumulated when the safety valve was blowing. He gave it as his opinion that the valve was closed at the time of the explosion. An inspection of the plates after the accident showed slight corrosion in the seam of one that wrapped over, but this corrosion would not have been discovered by an outward examination. The exploded boiler was connected with thirteen others, and was of a dangerous type through the men in charge not having control of the firing. The verdict was one of accidental death, the jury adding a rider, recommending the periodical hydraulic testing of boilers.

The nailmakers at Bromsgrove are resolute in continuing their strike. Their condition is very severe, and but for the assistance which is being rendered them, the strike would probably soon come to a close.

At a meeting of the Council of the Birmingham Chamber of Commerce, held last week, consideration was had to the proposed new Italian tariff, which would come into operation on January 1st next. The chairman—Mr. H. W. Elliott—said that many items in the tariff proposed duties of 100 per cent. on goods of local manufacture, and that as such increased duties must necessarily be detrimental to Birmingham trade, he suggested that a letter should be addressed to the Foreign-office directing the attention of her Majesty's Government to the matter, and asking them to take such steps as they deemed expedient to induce the Italian Government to forego the imposition of such prohibitive duties. The suggestion was approved.

Allusion was made at the Wolverhampton Chamber of Commerce at their meeting on Friday to the statement of the Hon. P. Stanhope, M.P., that Chambers of Commerce could not expect the consular service to be used for commercial purposes. The chairman, Mr. P. Ironmonger, said that the German Consul had assisted the commercial classes in Germany by forwarding through their consular service samples and particulars. It was because of that fact that pressure had been put upon the Government to give some assistance to the commercial classes of this country.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—The tendency of the market in the favour of buyers, to which I have referred in previous notes, has been still more marked during the past week, and both in the common and hematite qualities of pig iron prices have been decidedly easier. The lower prices which makers have been willing to take, have, however, in some instances brought forward a fair weight of buying, and there has perhaps been more actual business doing than for some time past. This has been chiefly confined to one or two of the districts and outside brands of common pig iron; hematites, although sellers are now willing to accept much lower offers than they were prepared to entertain a short time back, still meet with only a very slow sale. Manufactured iron remains without material change; makers are still kept very fully employed with shipping orders, and so long as they are not compelled to seek for business they are, of course, holding steadily to late rates.

The Manchester iron market on Tuesday was well attended, and although the continued downward tendency reported from Glasgow and Middlesbrough had necessarily a weakening effect upon prices, there seemed to be a disposition to buy at the lower figures, which makers were prepared to accept, the idea in many cases being apparently to take advantage of a temporary extreme depression in prices, and to cover at the lowest figure possible. In Lincolnshire foundry iron a very fair business has been done at about 37s., less 2½, delivered equal to Manchester, and there have been inquiries for forge iron, but in most cases the prices offered by buyers seem to have been lower than makers were willing to accept, the average makers' quotations being 36s. 6d., whilst buyers have offered about 1s. per ton under this figure. In Middlesbrough iron there has also been a fair weight of business done at about 41s. 6d. net cash for good named brands of foundry delivered equal to Manchester. Scotch iron continues to be offered here at very low figures, but not much business is reported. Derbyshire foundry is still quoted at about 40s., less 2½, delivered equal to Manchester; it could, however be bought at under this figure, but there does not appear to be business of any moment offering. Lancashire makers still hold to 38s. 6d. and 39s. 6d., less 2½, as their quoted rates for delivery equal to Manchester; they are, however, simply out of the open market, and what business they are able to do on the basis of the above figures is confined to occasional small sales to regular customers.

Hematites still meet with only a very poor demand in this market, and are weaker in price; for good No. 3 foundry qualities delivered into the Manchester district the average quoted price is about 52s. to 52s. 6d., less 2½, but sellers in most cases are prepared to come below this, and firm offers for anything like quantities would be accepted at very low figures.

The manufactured iron trade remains in much the same position as last reported; most of the local forges are still kept fully employed, chiefly, it is true, with shipping orders, but this for the present keeps them out of the market as at all anxious sellers, and price are firm at £4 17s. 6d. for bars, £5 5s. for hoops, and £6 7s. 6d. to £6 10s. for sheets delivered into the Manchester district. In some instances forge proprietors have orders on their books to keep them going for the next couple of months, but generally they have no weight of work ahead, and with the continued depressed state of the home trade, future prospects are not promising.

During the past week there have been some extraordinary speculative operations in this market in Scotch steel plates, which have been offered at 7s. 6d. and even 10s. per ton under the ordinary current rates. The sellers have, however, retained to themselves the option of selecting from four different brands; but even under these circumstances this heavy bearing of the market seems unaccountable. Business has been pushed vigorously amongst the boilermakers in this district, and I understand some considerable sales have been made. Local makers, however, still hold to £7 per ton for steel plates delivered in the Manchester district, and the leading Scotch makers disclaim any connection with the low prices which are being quoted by the speculative operators.

There is no specially new feature to report with regard to the engineering branches of industry. Machine tool makers, stationary engine builders, boiler makers, and machinists are, in most cases, kept fairly well supplied with orders, but it is only a few special firms that are at all pressed with work. The general condition is that engineering concerns are in a position to undertake considerably more work than they have in hand, with the result that there is an anxiety to secure any orders going out that keeps prices excessively low, and there is no present prospect of an increased volume of business coming forward to put the engineering trade on a stronger basis.

There have been no further negotiations with regard to a settlement of the Bolton strike, and so far as the employers are concerned, the matter would seem to be at an end. If the old hands choose to return on the masters' terms, they will, as far as possible, be found employment; if not, their places will be filled by men obtained from other districts.

The meeting of the Manchester Association of Engineers held on Saturday last was devoted entirely to short communications on the Manchester Exhibition, and a number of interesting papers were read. The first, and perhaps the most valuable, was one by Mr. S. Boswell, on "Materials used in Boiler Construction." After remarking that in this direction there was certainly not a very grand show at the Manchester Exhibition, Mr. Boswell referred to four stands where exhibits of interest might be seen. The first was Sir Joseph Whitworth's, where a solid weldless ring of fluid-compressed steel was shown. This, he admitted, as a forging, was a wonderful piece of work, but there was something of the white elephant kind about it, as it was outside its own space, as a weldless ring for boiler purposes, that the greatest difficulties would have to be met and overcome. He might be considered somewhat conservative in his ideas, but he really did not anticipate an immediate revolution in boiler practice, although the weldless ring might possibly become a practical solution of the vexed question of rivetted joints. The inner and the outer sides of the plates were, however, at present left full of "flats," which would have to be removed before a good metal to metal joint could be made, and with the tools at present in the hands of boiler-makers they could not with facility handle such rings, whilst a solid weldless ring, say 12ft. diameter by 10ft. long, would have to be made at the waterside. Again, he was not sure that fluid-pressed steel would meet all the requirements at present laid down and successfully fulfilled by mild boiler steel, whilst the cost was, and ever must be, a serious item. The next stand referred to was that of the Steel Company of Scotland, and the masterpiece there, if not of the entire Exhibition, was a flanged boiler half end for the lower half of the front end of a marine boiler 14ft. diameter. This Mr. Boswell described in detail, and remarked that as a sample of flanging by hydraulic machinery it stood second to none. Messrs. Bolckow, Vaughan, and Co. showed some exceedingly fine samples of flanging by hand, but taken from a boiler-makers' point of view, perhaps the finest exhibit was that of the West Cumberland Iron and Steel Company in the form of a portion of a collapsed flue tube. This consisted of two plates connected by means of a flanged seam. The entire flue of which it at one time formed part was at work at a colliery in one of the Midland Counties, where it was allowed to get short of water. The result was overheating the plates to such an extent as to cause them to be forced down almost on the bars. The plates would thus not only be subjected to a hot rending test, but they would also be subject to a very high tensile strain, and as most metals lost their strength in a marked degree when hot, they would admit that it must be excellent metal that would stand such a test as here shown in which the stretch of the metal without sign of fracture in 33in. was no less than 28 per cent., while the high tensile strain was amply shown by the manner in which the flanged seam had beeen crumpled up. This was one of the cases which clearly proved the advisability of having flues well strengthened with anti-collapsing seams of one form or another. Taken together, the exhibits he had mentioned should at least have one effect upon the minds of observers, and that was, if they were still sceptical as to the qualities of steel for boiler purposes, such scepticism should be removed, particularly when they found there were really no exhibits of iron, perhaps because the maker did not dare to place these side by side with mild steel, now almost universally adopted for high-class boiler work. Mr. Ashbury pointed out that the weldless ring shown by Sir Joseph Whitworth and Co. was simply a forecast of what might be expected in the future, and he thought it augured a great change in marine boiler making. Mr. Rawlinson remarked with regard to the difficulties of manufacturing, that it was really too late in the day for engineers to consider these as obstacles to progress. Mr. Thos. Ashbury, C.E., next read a paper describing the locomotives at the Exhibition, and remarked that the compound engine shown by Mr. Webb did him the highest credit, and he was to be congratulated that he had so persistently adhered to his compound system, which had held its own and realised the results expected. Mr. J. Horsley described the samples of pipes that Messrs. Macfarlane, Strong, and Co. are making for the Bombay and the Thirlmere Waterworks, and referred to an important advance which he said had been made in the designing of pipes for conduit work. Ordinary pipes were provided with socket and spigot ends, but Mr. Hill, the engineer to the Thirlmere scheme, had determined to employ, to a large extent, pipes with plain ends which would butt against each other and were jointed with collars. This method of jointing had seldom, if ever, been adopted in this country, but if all the advantages anticipated from its use in the Thirlmere scheme were realised, it would lead to hydraulic engineers revising their practice. Knap's turbine was next described by Mr. J. Ingleby, and Mr. W. Schroller read two short papers descriptive of Simons' continuous ammonia still and the Simon-Carvé coke oven. Mr. R. Sugden gave a practical description of the four large engines which supply the motive power to the machinery, and claimed the greatest novelty for the pair of Wheelock engines put down by Messrs. Daniel Adamson and Co., adding that they also agreed better with his ideas of an engine for machinery turning than any he had yet come across. Short discussions followed each paper, and the proceedings then closed with the usual votes of thanks.

In the coal trade a fairly brisk business continues to be done in the better qualities of house fire consumption, and in the West Lancashire district there is a general talk of putting up prices 6d. per ton next month, but the leading Manchester firms have decided to do nothing with regard to prices at present. Other descriptions of fuel for iron making, steam, and engine purposes, continue only in dull demand, plentiful in the market, and quite as low in price as ever, and this applies equally to steam coal for shipping purposes.

Barrow.—A quiet tone still exists in the hematite iron trade. It is difficult, however, when the position is analysed to explain why this state of things exists, alongside of the fact that iron ore is very brisk and firm, and the steel trade quite active. There is but one solution of the matter, and that is the effect which has been brought on hematite by the action of speculators; but while the latter have been disposing of hematite warrants at as low a price as 41s. per ton net at three weeks, makers of iron are firm in asking 42s. for No. 3 forge and foundry iron to 44s. for Bessemer iron in parcels of mixed numbers. Notwithstanding the low rates of warrants, on which, by-the-way, there is not much guarantee of quality, business is doing by makers at their own rates, and the best brands will always command good markets. The output of iron is still fully maintained, and as yet there has been no attempt to blow out any of the furnaces, as has been threatened in order to check the downward tendency in prices. There can be no doubt that with iron ore brisk and steel active, the pig iron trade must very soon participate in a better state of things. With this view makers are slow to sell for forward delivery. The stocks on hand are large, but not unreasonably so, and would be cleared out in a short time if the output was curtailed. Steel makers are not only busy, but the demand is fully maintained for rails, bars, billets, &c. Heavy sections of rails are quoted at £4 2s. 6d. per ton net f.o.b., and blooms, for which there is little inquiry, from £3 17s. 6d. to £4 per ton net f.o.b. There is very little inquiry for steel for shipbuilding purposes. Prices are quoted for delivery here at £5 15s. per ton for Siemens' plates to stand Lloyd's tests. Billets and slabs are in good inquiry at about £4 2s. 6d. per ton net. There is nothing new to note in the shipbuilding trade, which is very quiet. Engineers are rather better off for orders. The Barrow Shipbuilding Company has been entrusted with the order to build a pair of paddle engines for H.M.S. Investigator, now building at Plymouth. There is an improvement to note in the iron ore trade, as the advance in prices on Spanish ore, consequent on the increased freights, has again opened up a trade with South Wales for Furness and Cumberland iron ore. The coal and coke trades are steady and well employed, and prices are firm. In the shipping trade there is a quieter tone. The Marsh Ironworks of Messrs. Kirk Brothers, of Workington, which have been standing idle for some time, have been restarted in the manufacture of bar iron.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THE South African market is attracting renewed attention. There is no doubt that fortunes are being rapidly made out there in the gold and diamond mines. A Sheffield manufacturer gave me some interesting information a few days ago of the flood-tide of prosperity which has set in for the Transvaal. Two or three years ago he was in despair of ever being able to resume business with the Cape and South African markets generally. Now he is full of work, and orders come in by every mail. They are mainly for axes, adzes, picks, shovels, and mining appliances. Cutlery and other requisites are also gradually being ordered as people get settled in their new quarters. Johanisberg, twelve months ago a collection of settlers' shanties, is now a town of 40,000 inhabitants, with five hotels and several banks. One mine has paid 240 per cent. dividend within a year. A traveller for an Eastern Counties firm of agricultural machinery makers resigned his appointment the other day. While in the Transvaal he purchased an allotment of land, which he re-sold within the twelve months, clearing £25,000 by the transaction. There is some fear of the rush being overdone. Already the tidings of luck are causing home capitalists to invest in land in the hope that they may "strike gold" as the traveller did.

More cheerful reports with regard to iron and steel come from the United States, and there are statements of increased prices being obtained in the Black Country. As yet the improvement in the iron industry has not touched the Sheffield district, but the steel trade continues to get brisker, mainly, however, in the lower grades, and in railway material the demand is heavy enough to justify another advance in values, though I have not yet heard of that step being taken.

Colonel Brackenbury, R.A., director of the Artillery College, who was accompanied by several officers of the Royal Artillery from Woolwich, paid on the 20th inst. a visit to the works of Messrs. Charles Cammell and Co., Messrs. W. Jessop and Sons, and Messrs. Vickers, Sons, and Co., where they inspected the various processes of manufacture, particularly those relating to guns and projectiles. They also visited the works of the Hadfield Steel Foundry Company, to inspect their armour-piercing shrapnel and other steel projectiles, and the manufacture of steel castings. On the 21st they went to the old-established Wortley Forges. The visitors were received and conducted round the works of Mr. Thomas Andrews, who showed them many objects of interest, including the ancient forge hammer, nearly 200 years old, and also one of the first rolling mills put down in Yorkshire, to carry out the invention of the unfortunate Henry Cort, nearly a century ago. The officers witnessed the manipulation of Wortley iron, from the rough state into the finished article, including bars used for loom cranks, railway work, chains, colliery and other purposes; large chains for lifting heavy guns attracted notice, particular notice being taken of the preparations for forging one of the most massive chains hitherto constructed, which is intended for lifting one of the largest type of modern steel guns.

It has been freely rumoured in these parts for some time that working arrangements were about to be made between the Hull and Barnsley and North-Eastern Railways. A distinct contradiction is given to these rumours, which are stated to be "wholly unfounded." One great object of joining the line was to break down what was called "the monopoly of the North-Eastern." "Working arrangements" made by a struggling company with a prosperous one is simply a euphemism for gentle absorption.

A Parliamentary return has just been issued of the number of ounces of gold and silver plate upon which duty was paid into the various halls in Great Britain in each year from 1878-79 to 1886-87, the number of ounces upon which a drawback was allowed, and the number of watch cases hall marked, distinguishing those of British from those of foreign origin. At the Sheffield Assay Office duty was paid on 113,881 ounces of silver during 1886-87, and drawback allowed on 315 ounces, with 11,152 ounces assayed under the voluntary system. These figures show that in spite of the depression of trade—and in no department has complaint been more severe than in the production of silver and plated goods—business has steadily advanced since 1879-80, when the weight was 73,598 oz. The returns show the net weight on which duty was paid, *i.e.*, the gross weight, less the deduction of one-sixth allowed in respect of unfinished articles. A very large business is also done at the Birmingham Assay Office, but it may be questioned if the figures will exceed those of Sheffield to any considerable extent. No watch cases are made or hall marked in Sheffield.

The Midland Railway Company has recognised the extra and important services rendered during the recent strike of drivers and firemen by presenting to each of the officers and servants who remained loyal to the company a resolution proposed by the chairman and seconded by the deputy chairman in these terms:—"That the directors desire to express to the officers of the company and to the servants engaged in the conduct of the traffic their high appreciation of the services rendered and of the zeal and loyalty to the company displayed during the late period of exceptional difficulty in working the traffic of the line."

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THERE are as yet no signs of improvement in the Cleveland pig iron trade. Last week scarcely any business was done, although sellers continued to press their iron on the market and endeavoured by further concessions to tempt buyers. At the market held at Middlesbrough on Tuesday the prevalent feeling was one of despondency, and but few sales were made. It is indeed scarcely to be expected that consumers will re-enter the market until they have reason to believe that prices have reached the bottom. Quotations for No. 3 g.m.b. were made by merchants at 32s. per ton and by makers at 32s. 3d., being a reduction on last week's prices of 6d. per ton, in either case. Offers by buyers to place orders at 31s. 9d. per ton were not accepted. The demand for forge iron is scarcely any better than for No. 3. The price has fallen 9d. during the week and now stands at 30s. 9d. per ton.

Stevenson, Jaques, and Co.'s current quotations: "Acklam Hematite," mixed Nos., 44s. per ton; "Acklam Yorkshire," Cleveland, No. 3, 33s. 6d.; "Acklam Basic," 35s.; refined iron, 48s. to 63s., net cash at furnaces.

Buyers of warrants offered 31s. per ton, but sellers asked 3d. more, and no business resulted. A week ago the price current was 31s. 9d.

The stock of pig iron in Messrs. Connal and Co.'s Middlesbrough store decreased 354 tons last week, the quantity held on Monday being 327,880 tons.

Pig iron shipments improved somewhat of late, by reason, no doubt, of the better weather. The quantity sent away between the 1st and 24th inclusive was 58,140 tons, or about 1000 less than during the corresponding portion of September.

In the finished iron trade no improvement has taken place, and makers continue to have the greatest difficulty in getting sufficient orders to keep their mills going. Prices remain unaltered.

The owners of those finished iron works which have been standing for some time, and which are less favourably situated than the majority for successful conversion into steel works, are in several cases selling off their plant by auction or by private contract. They thus seem to have come to the conclusion to accept the situation and realise their loss. Two or three weeks since the Imperial Ironworks, situated at South Bank, were sold off.

The plant consisted of puddling furnaces, a forge train, mill furnaces, bar mills, hammers, engines, boilers, roofs, shears, &c., all of which were sold without reserve. Among the largest items were the cast iron floor plates, of which there was a considerable quantity. The prices realised were very low.

The cast iron work, taken by itself, and including machinery, rolls, and floor plates, did not fetch much more than 30s. per ton all round. Several second-hand shunting locomotives, from another source, were put into the sale, but there was no bid for them whatever. Much of the plant was, as usual, purchased by middlemen, some of whom acted on commission, but others bought in order to re-sell.

Since the above sale took place, the works of the Hartlepool Malleable Iron Company have been sold by private contract at a very low price. The firm who purchased them is believed to be the same as that which purchased the Stranton Ironworks some time since. It is understood that their object is to break up and use,

or re-sell. It is rumoured that the Skerne Ironworks at Darlington, which for many years has been inoperative, is likely soon to be sold, either by auction or by private contract, and broken up. In all these cases the position of the works is not favourable for steel-making. They were originally placed where they are to be near the coal supply. In the manufactured iron trade, where 50 cwt. of coal is used per ton of finished product, against 25 cwt. of pig iron, it is obviously more important to be near the coal than the pig iron. In steel making it is just the reverse, besides which, nearness to pig iron at present means also nearness to shipping facilities. The steel manufacture is likely to develope in future, mainly, or only at seaport towns. Should the Siemens basic process come into vogue, as seems probable, Middlesbrough is not unlikely to become predominant in this, as it used to be in the now almost departed finished iron trade.

The days during which the Jubilee Exhibition at Newcastle-on-Tyne will still remain open are now numbered. Last week, committees and sub-committees of jurors, were busy inspecting the various exhibits, whose owners had expressed a desire to enter into the competition for awards. Whether or not these awards, when known, should lead to the usual amount of satisfaction and dissatisfaction, it is certain that the jurors have been sparing no pains to do their duty according to the best of their judgment. It is said that complaints have been made to the effect that several exhibits were inspected and adjudicated upon in the absence of the exhibitor, or his representative, to explain them. This, however, must always be the case. Notice was duly given that inspection by jurors would commence on a certain day and at a certain hour. Obviously, however, as the same committees were working several days in succession, they could not be at all the exhibits at the time fixed for the beginning of their operations. It is undoubtedly tiresome to an exhibitor to have to wait about in a cold building for two or three days. But if he goes away, and in his absence his exhibit is visited, he cannot reasonably complain or demand a second visit. It is understood that the Exhibition as a whole will have turned out a profitable venture, a respectable balance being likely to remain after all expenses are paid. The leading engineers, manufacturers, and public men of Newcastle certainly deserve the greatest credit for the spirited way in which this Exhibition was got up, and carried through to a successful issue.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow pig iron warrant market has been comparatively idle this week. Buyers and sellers have been alike indisposed for business, and the prices of warrants have been slowly receding, having fallen to a lower point than before, touching the lowest price of the year. While the warrant market has been thus inactive, the shipments have been good. For the past week they amounted to 9889 tons, as compared with 8651 in the corresponding week of 1886. There was despatched to the United States 1350 tons; Canada, 1792; Italy, 710; Australia, 288; Holland, 200; and France, 150; quantity sent coastwise being 2974 tons. The additions made to stocks in the warrant stores are larger than of late, and there is a scarcity of fresh shipping orders at the moment. Since last report one furnace has been put out at Wishaw, the total now blowing being 83 against 66 twelve months ago.

The current values of makers' pigs are generally about 6d. per ton lower, as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 46s. 6d.; No. 3, 42s. 6d.; Coltness, 50s. 6d. and 43s.; Langloan, 47s. 6d. and 44s. 6d.; Summerlee, 49s. 6d. and 42s.; Calder, 47s. and 40s. 6d.; Carnbroe, 42s. 6d. and 39s.; Clyde, 45s. 6d. and 40s. 6d.; Monkland, 42s. 6d. and 38s. 6d.; Govan, at Broomielaw, 42s. and 38s. 6d.; Shotts, at Leith, 47s. and 44s. 6d.; Carron, at Grangemouth, 49s. and 43s.; Glengarnock, at Ardrossan, 47s. and 40s. 6d.; Eglinton, 41s. 6d. and 38s. 6d.; Dalmellington, 42s. 6d. and 39s.

There was shipped from Glasgow in the past week £5500 worth of locomotives, £9688 sewing machines, £6749 machinery, £31,147 iron, and £8875 steel manufactured goods.

Spanish ore is firm in price, 14s. 6d. per ton being quoted delivered in the Clyde.

The past week's imports of Cleveland pig into Scotland were 8592 tons, as compared with 4785 in the same week of last year.

There is a slight improvement in the malleable iron department, shipping orders being more plentiful, while the home demand is fairly well maintained. The current price of merchant bars is £4 15s., less 5 per cent. discount. Inquiries from India for unmarked bars are backward at the moment, the price being £4 7s. 6d. net. Old rails and scrap iron are both quiet at the moment, and quoted at 57s. and 47s. respectively. Steel makers have been chiefly interested in the orders that are being placed in connection with new vessels contracted for by the Clyde shipbuilders. The specifications for these are reported to generally mark a slight reduction on former prices, the fall in one or two instances being reported as considerable, merchants being credited with contracting to supply the steel at rates which they will find it very difficult to persuade manufacturers to accept.

The coal trade has exhibited increased activity in the home department, as result of colder weather.

The shipping trade is unsatisfactory. There has been a scarcity of vessels at some of the ports, due partly to ships being delayed by unfavourable weather, and partly to the extra demand and higher freights paid for tonnage at Newcastle. The prices of shipping coals are lower than ever, the staple quality shipped—main coal—being delivered free at ship in Glasgow harbour at 5s. 3d. to 5s. 6d. per ton. The past week's Scotch shipments have been: At Glasgow, 22,547; Greenock, 69; Ayr, 10,762; Irvine, 2504; Troon, 5897; Ardrossan, 2574; Burntisland, 12,600; Leith, 6462; Grangemouth, 12,242; Bo'ness, 3567; Granton, 3588; and Port Glasgow, 2190, the total of 85,022 tons contrasting with 89,139 in the corresponding week of last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Appearances are now favourable for a peaceful solution of the sliding scale difficulty. The opinion amongst the well-informed has always been that the colliers would not willingly forego the scale. They have found its action to be just, for if it has compelled them to take low wages when coal was low, they have shared in all the advances of price. But the fact is, that the jealousy of some of the representatives has been at the bottom of the mischief. They have prompted disaffection in order to get more power, and become of more importance. The good sense of the colliers has enabled them to see through this, and at a large meeting of colliers held on Monday, in Merthyr, which has now become the "head centre" for collier gatherings, the question was brought to the test. There were present at the meeting 104 delegates, these represented 40,474 men, and the result of the voting, after the subject had been vigorously discussed, was that the majority voted in favour of retaining the scale. The exact figures were as follow: For the maintenance of the scale, 21,720; against the present scale, 18,000; neutral, 500.

It will be understood that delegates representing this number of men voted as stated, and although it may seem a precarious majority, yet it was understood at the meeting that a large proportion of the delegates representing the 18,000 men would have been stubbornly against any attempt to do away with the scale. Their negative meant that the scale required additions, and amendments, and this will again come to the front. At present it may be assumed that the scale is safe, and the rocks ahead passed. Just at this turning point, too, it is well to note that the coal trade is improving all round, and for best kinds of steam quotations are a trifle higher. The demand is well maintained for steam and house coal, and small bituminous and small steam. For the last quotations are 3s. 6d. again.

Ruling prices at Cardiff this week: Steam, from 8s.; Newport, 7s. 6d.; Swansea, 8s.; bunker steam at Swansea, 6s. 9d. to 8s., according to quality; house coal at Cardiff, 8s. 3d. Rhondda No. 3 is firm at this price, and in some cases is selling at 8s. 6d. Welsh cokes are in good demand at 16s., foundry 14s., furnace 12s. Swansea is offering good coke at 12s., but 14s. 6d. to 17s. for foundry. Pitwood is at 16s., and advancing.

There has been a flutter again in the railway world in regard to a local rumour that the Taff Vale and Rhymney Railways were likely to be amalgamated. I do not think there is the slightest grain of truth in it. Many shareholders of the Rhymney would hail it, but however excellent the result in many ways, and looking from various points, there is little prospect yet of such a step being brought about.

A good movement is promised at Treforest. The Forest Company, which has extensive works and collieries near Pontypridd, has acquired the Taff Vale Works, formerly owned and worked by Mr. Richard Fothergill. Like Llwydcoed, Abernant, and Plymouth, these works were closed at his failure, and have remained so; but now, in changing hands into those of so good a company, much public benefit will be derived. The leading spirit of the company endeavoured some time ago to acquire Plymouth Works, but was prevented doing so, unfortunately, and their destiny would appear now to be settled. With respect to the Taff Vale, the idea is a Siemens works. The site is ten miles to Cardiff, so that competing works at twenty-four miles distance will be handicapped rather heavily. The new works will get their foreign ore, coal, and coke at a cheaper rate than others, and in turn the manufactured article, blooms and bars, can be sent to destination for less. On the other hand, while I note the re-start with satisfaction, and think that Sir W. T. Lewis, the leading mind of the movement, has again scored a substantial success, and a great public benefit, the miners will have to struggle almost as much as others in the competitive race, and must work with a will. Here, for example, is Dowlais making capital large plates and sending them to the Landore Bridge, thirty miles, though in the immediate neighbourhood of the bridge, steel sheet manufacture forms one of the special features. Dowlais, I regret to say, is beginning to suffer again from the drought. If no rain of importance should fall during the next two weeks there must be partial stoppage, at least, again. There has not been such a rainless year for the last quarter of a century.

A good deal of business is being done at the various steel works. From Blaina to Blaenavon and Tredegar to Cyfarthfa there is a fair amount of activity. I was in the Cyfarthfa district this week, and was enabled to examine steel samples similar to those sent to the Newcastle Exhibition. The splendid character of the steel may fittingly be described as evincing the ductility of lead. The cold mild steel experiments have resulted in bars being pressed quite flat, thus beating all competitors; in being turned into spiral columns, into heart shapes—in fact, into all kinds of forms, without the slightest fracture. One of the best steel experiments was very remarkable. A piece of steel was punched into holes so near the margin that had it not been of the finest steel the piece must have been split up. These, as well as the Dowlais samples now on exhibition at the Cardiff Free Library, deserve more than a passing notice.

Prices remain the same as last week for rails, blooms, and bars. Foreign ore lowest quotation, 12s. Large quantities are coming in from Bilbao.

In tin-plate there are rumours of a temporary stoppage at Monmouthshire, but facts are wanting.

In the Swansea district new business is slack owing to the advance in prices of tin. Exports are well maintained. Quotations little altered from last. At the Exchange cokes were quoted from 12s. 9d.; Bessemer, 13s.; Siemens, 13s. 6d.; ternes, 24s.; coke wasters, 12s. 6d. As 78,000 boxes were sent away last week, and only 40,000 made, stocks are low. Prices certain to advance.

NOTES FROM GERMANY.

(From our own Correspondent.)

The position of the iron markets, all along the line, has been a firm one all through the week, and in most branches the tendency of prices has been towards a rise. The less favourable quotations from England have not the influence on the German markets which they used to have a few years back; they are now more dependent for their tone on America, so the sinking of warrants in Glasgow has no effect on prices here. Also, a glance at the markets of the other groups shows that in Silesia the pig iron trade continues very buoyant at firm prices, and that the rolling mills, forges, and foundries, &c., are working away most satisfactorily, and similar favourable accounts come from the rest, including the neighbouring one of Austria. In France the iron business keeps very unsteady, and the continued war between the Paris *Caissiers* and the iron works keeps the prices depressed to a degree, whilst the Belgian market shows no sign of relaxation, and prices remain firm, though perhaps fewer fresh orders are coming in.

In the Rhenish-Westphalian district, ores are still in full demand, M. 12·60 being still paid for roasted steel stone. Spiegel and forge iron are in continued good request, and basic pig has advanced M. 2 p.t., and is now quoted at M. 43 to 44. The new wrought iron convention has become definite till the close of 1890. Prices of bars are firm in consequence, but cannot be improved till the earlier bought stocks of middlemen are cleared off. A large weight of rails has been given out lately, the tenders having ranged from M. 116 to 125 p.t., whilst an English offer was M. 123·60 at Bremerhaven, and 124·60 at Harburg. The finished sets of wheels and axles were offered at M. 300. A convention of all the wire nail makers is a settled matter, though not signed, and the prices of this article will be at once advanced. Sheets are in as good demand as ever at M. 137 to 140 p.t. The brass founders are full of work, but at too low prices. There is no improvement or change to note as regards the machine and constructive shops. Coals are 2d. p.t. dearer than as last noted.

I give the continuation from last week of the report of the Düsseldorf Chamber of Commerce for 1886:—"For the machine tool manufacture the year 1886 was also unfavourable, inasmuch, as the depressed condition of trade in general caused less demand for these machines, and consequently orders could only be obtained at very low prices. If just some of the best situated works considered it advisable to put down more powerful and better machines when the old ones were too weak to deal with steel, which is continually coming more and more into general use, and in consequence of competition were unable to turn out enough work in order to reduce the cost of production, still, the slight prospect of any improvement in the situation this year, caused only very few to do so. It was only in the second half of the year, when greater demands on the German iron and steel industry were made from abroad, that a greater call for machinery set in, but which soon became checked by the fears of war, which had arisen in the meantime. The railways did not add any new plant to their machine shops, and the general unprofitable condition of trade caused few new machines to be ordered anywhere. There was not the least request for them at the shipyards, as most of these had not work enough to keep the old machines employed. About the middle of the year there came some pressing demands for machine tools from the military workshops, but this only caused a momentary spurt. The deliveries abroad were very small—firstly, because there was little demand; and secondly, the prices, through competition, were so reduced that no profit could be realised. The high foreign duties have greatly hindered the sale of wire-drawing machines and apparatus, the larger portion of which used to be exported, and for which there was a good demand.

"The foundries could only be kept on at reduced prices and with restricted output. Although towards the end of the year a rise in pig iron took place, till now there has been nothing but a fall in the already so reduced price of castings to relate, a certain sign that consumption is not in normal proportion to production. Especially in the pipe foundries, in spite of a moderately good demand, the prices have reached such a point that all profit is excluded from the account. A combination was mooted, but it came to nothing. Through the competition of Belgium and England, which possess the advantage over us of cheaper raw materials, the export by native works becomes very difficult.

"The forgers of heavy pieces, particularly for shipbuilding, complain still of the English competition, because these articles are imported duty free, and yet England has cheaper materials and water carriage, and in these circumstances the result of this branch of business were unfavourable, and so much the more so because the demand for vessels was hardly worth mentioning.

"The year 1886 can only be called an unfavourable one for the wire rod and wire branch. The prices kept persistently falling, and this caused the wire-rod combination to be dissolved on July 1st. A better demand from America coming in November and December caused an improvement in prices, but whether this will last cannot be foretold. Now that Russia has completely shut out the importation of wire, and North America keeps aloof more and more, with the great increase in the native production, added to that of Belgium and England, the competition in the over-sea markets is ever becoming severer. As concerns the ability to export, when it is a question of manufactures in weighty quantities, the most important factor is the railway freight. In the eastern district, for instance, the coal freights are much lower; if the coal freights of this district were the same for distances above 50 to 60 kilom., this would make a difference on the raw materials, as pig iron and steel billets of M. 3 to 4 per double wagon—10 tons. It is also much to be regretted that our petition was not listened to with regard to lowering the carriage on iron vitriol lye, which is produced in such large quantities at the wire mills, and must now be left to run to waste, because the iron vitriol makers cannot afford to pay the freight on it as charged by the present tariffs. Also the by no means inconsiderable factories for tinned and enamel wares complain very much that the demand is not commensurate with the power of production, through the establishment of new, and the unlimited extension of the old, works.

"The iron industry raises a general, well-grounded complaint of the too high railway freights on heavy goods in large parcels, a suitable reduction of which would enable the blast furnaces to produce crude iron cheaper, and the export manufacturing works to deliver their goods on foreign markets at a lower figure. In this way the competition on the foreign markets would be facilitated, the employment of the native works increased, and, in consequence, more freight brought to the railways, which would in a great measure compensate for the reduction granted. The year 1886 was not favourable to the trade in iron and steel goods, and nothing gratifying can be reported on it. In order to secure orders in the usual way, it required great exertions, and yet no adequate profit could be realised. For most articles there was a constant fall in prices, and it was only in the fourth quarter, in consequence of the rise in pig iron, that trade became a little brisker, and a slight increase of price on finished goods was obtainable; still there was no confidence that prices would be maintained. The present year has brought no improvement, and after a few months, the hope of better prices in general has been delusive."

LAUNCHES AND TRIAL TRIPS.

The Drummond Castle, the second of the Castle line of Royal Mail steamers which has been tripled by Messrs. T. Richardson and Sons, of the Hartlepool engine works, left Hartlepool on Saturday for a full-speed trial of her new machinery. The original engines were built by Messrs. John Elder and Co. in 1881, and were of the two crank compound type, having cylinders 51in. and 88in. diameter, with a stroke of 4ft. 9in. These have been converted into three crank triple expansion, with cylinders 33in., 55in., and 88in., steam being generated in three very large double-ended boilers at a pressure of 150 lb. During the twelve hours' trial the engines worked most satisfactorily, after which the ship was taken over by the representatives of the Castle Company, and left for London, where she arrived in due time, having made a very successful passage. Besides the alterations to the main engines, a large refrigerator has been fitted, by means of which the passengers will be supplied with fresh meat, fish, milk, &c., throughout the voyage. All the cabins which were damaged by fire in London have also been renewed by Messrs. Withey and Co., of the Middleton Shipyard, and the whole of this work was accomplished in the short space of fourteen weeks. Messrs. Richardson and Sons have been advised by the Currie Company that the saving of fuel on the Grantully Castle, as compared with the old engines and boilers, has been 34 per cent. on the voyage from London to Cape Town, and this great success has resulted in a decision to place their finest steamer, the Roslyn Castle, in Messrs. Richardson's hands to triple, and she will arrive in Hartlepool early next year. This great saving in fuel has also been accomplished in the Union Company's s.s. Trojan, which has just returned from her third Cape voyage. It is an interesting fact that the Drummond Castle's engines complete the large total of 30,000 indicated horse-power, which has been manufactured by Messrs. Richardson and Sons since last January, and is the greatest output they have ever recorded in so short a space of time.

The Earles' Shipbuilding and Engineering Company have launched the Apollo, a screw steamer built for Messrs. Thomas Wilson, Sons, and Co., for their Bombay trade. The dimensions are 330ft. by 41ft. by 29ft., and the ship is constructed to Lloyd's highest class of steel; she has two complete steel decks, and bridge-deck extending over engine and boiler space, a turtle back forward, and house aft, with hood enclosing the stern. Accommodation is provided under the bridge for captain and twelve passengers, with comfortable dining-saloon, state rooms, and every necessary convenience, all fitted up in a very substantial manner. The officers and engineers are berthed in the house aft, and the seamen and firemen forward, under the upper deck. The holds and 'tween decks are thus entirely available for cargo; water ballast is provided for in two large hold tanks suitable for cargo; the pumping arrangements for these and the rest of the ship being very complete and efficient, as there are large deck pumps worked from the winches as well as the engine-room pumps. The ship is rigged as a schooner, with two pole masts, and very complete and ample arrangements of derricks, and booms are carried out for the quick working of cargo. The provision for steering is of extra strength, and consists of a steam steering gear made by Messrs. Amos and Smith, and a powerful Hastie's hand screw gear. The rudder and portion of the stern-frame are made of cast steel, manufactured by Messrs. W. Jessop and Son, of Sheffield. Her machinery, which has also been made by the builders, consists of a set of triple compound three-crank inverted engines, having cylinders 25in., 40in., and 66in. diameter by 48in. stroke, and two double-ended boilers of ample size, made in accordance with Lloyd's and Board of Trade requirements for a working pressure of 160 lb. per square inch.

Messrs. J. F. Waddington and Co., Seacombe, have launched a handsomely modelled steam launch, named the Olinda, built of galvanised steel, for Messrs. H. Savill and Co., of London, for the Brazilian Government. The craft is 45ft. 6in. by 8ft. 6in. moulded, by 4ft. 6in. moulded, with bulwarks at ends and rails amidships. The engines, also built by Messrs. Waddington, have cylinders 6in. and 12in. diameter by 9in. stroke. The boiler is of the horizontal return tube type. On the preliminary trial of the engines they were found to work very smoothly, running at a speed of 240 revolutions without the slightest hitch, the launch attaining a speed of ten miles per hour. She will be shipped in a few days to the Brazils.

NEW COMPANIES.

The following companies have just been registered:—

Alcanices Tin Mining Company, Limited.

This company was registered on the 15th inst., with a capital of £45,000, in £5 shares, to purchase from the Comte de Poix certain tin mines situate in the province of Zamora, Spain, known as the Alcanices Tin Mines. The subscribers are:—

	Shares.
Arthur Straus, 9, St. George's-square, S.W., merchant	1
A. H. Straus, 19, Pembridge-gardens, W., merchant	1
E. Hartmann, Upton Park, Essex, clerk	1
E. J. Tooley, 26, Bismarck-road, N., clerk	1
H. Hilly, 42, Upper Bedford-place, clerk	1
W. H. Solomon, 3, Clonbrook-road, N., clerk	1
E. Settelen, 10, Gower-street, W.C., clerk	1

The number of directors is not to be less than three, nor more than seven; the subscribers are to appoint the first. Most of the articles of Table A are adopted.

Barrett Gold Mining Company, Limited.

This is a reconstruction of a company of the same title, carrying on mining operations in the South African Republic. It was registered on the 14th inst., with a capital of £240,000, in £1 shares. Every member of the old company will be entitled to one new share credited with 18s. paid up in respect of every share held in the old company. The subscribers are:—

	Shares.
A. Fass, 70, Queen Victoria-street, merchant	1
A. R. Campbell-Johnston, 84, St. George's-square, S.W.	1
G. Christie, 40, Queen Victoria-street, merchant	1
J. Mackie, 14, Capel-terrace, Bow, accountant	1
J. Barber, 5, Christ Church-road, Brondesbury, accountant	1
W. Westcott, 99, Gresham-street, accountant	1
J. Adler, 15, Coleman-street, merchant	1

The number of directors is not to be less than three, nor more than seven; the first are Messrs. R. G. Morley, J. S. Prince, and W. M. Farmer; qualification, £500 in shares or stock; remuneration, £500 per annum.

Beverley United Lead and Barytes Mining Company, Limited.

This company was registered on the 14th inst., with a capital of £15,000, in £1 shares, to purchase, for a term of twenty-one years, the mineral properties at Beverley, in the West Riding of Yorkshire, known as Stoney Groves, and part of Prosperous and Providence, and also to purchase for a like period the Merryfield Mining Grounds at Stonebeckdown, in the West Riding. The subscribers are:—

	Shares.
*W. Woodmass, Harrogate, merchant	1
J. P. Walker, Harrogate	1
D. Hebblethwaite, Harrogate, grocer	1
T. Proctor, Shipley, clerk	1
W. Bostwick, Leeds, agent	1
W. Clarkson, Harrogate, agent	1
J. Tipper, Leeds, hatter	1

Messrs. T. R. H. Hutchinson, R. Ingleby, and Wm. Woodmass are the first directors; qualification, 100 shares. The company in general meeting will determine remuneration.

Newbery-Vautin (Patents) Gold Extraction Company, Limited.

This company proposes to purchase the rights, property, assets, and effects of the Cosmo Newbery-Vautin Gold Extraction Syndicate, Limited, London, and the Newbery-Vautin Gold Extraction Company, Limited, Melbourne. It was registered on the 15th inst., with a capital of £100,000, in £1 shares. The subscribers are:—

	Shares.
J. Paddon, Suffolk House, Laurence Pountney-hill, merchant	1
J. Chappell, 24, Basinghall-street, manufacturer	1
J. J. Rogers, 70, Malta-road, Leyton, clerk	1
G. W. Cox, Walthamstow, clerk	1
W. Bohm, 23, Old Jewry, solicitor	1
A. W. Robertson, 3, Cork-street, and Melbourne	1
C. Howard, 185, Clapham-road, clerk	1

The number of directors is not to be less than five, nor more than nine; qualification, 500 shares; the subscribers are to appoint the first. The company in general meeting will determine remuneration.

Rudge Cycle Company, Limited.

This company was registered on the 17th inst., with a capital of £200,000, in £5 shares, to trade as cycle manufacturers, wire-drawers, metal tube manufacturers, ironfounders, brassfounders, metallurgists, and producers of metals and alloys. Two unregistered agreements, dated respectively the 7th and 11th inst., are to be adopted by the company, particulars of which are not given in the documents filed at Somerset House. The subscribers are:—

	Shares.
Lieutenant-Colonel A. M. Creagh, Bromley, Kent	1
G. F. Urling, 33, Mildway-chambers, Bishopsgate, merchant	1
Ernest Bigland, 7, East India-avenue, merchant	1
T. G. Beard, 10, Basinghall-street	1
T. H. Ingram, 32, Craven-terrace, Hyde Park	1
J. B. Roche, 2, Eccleston House, S.W.	1
G. T. Llewellyn, Watford, Herts, solicitor	1

The number of directors is not to be less than three, nor more than five; the first are Messrs. Ernest Villiers, 5, Brechin-place, S.W.; Hy. W. Lowe, 7, East India-avenue; James Judd, 40, St. Andrew's-hill; and the Hon. T. F. Freemantle, of 22, Chesham-place, S.W. The first directors are not required to hold any share qualification; remuneration, £1050 per annum, and reasonable expenses; qualification for subsequent directors, fifty shares.

John Holroyd and Company, Limited.

This is the conversion to a company of the business of engineer, machine and tool maker, carried on by Mr. John Holroyd, Tomlinson-street, Hulme, Manchester. It was registered on the 14th inst., with a capital of £25,000, divided into 2100 ordinary or "A" shares of £10 each, and 400 "B" or deferred shares of £10 each. The subscribers are:—

	Shares.
*J. Whitworth, MacGowan, Didsbury, Manchester, engineer	1
*C. MacGowan, Manchester, engineer	1
*E. Licbert, Manchester, merchant	1
*H. Licbert, Manchester, engineer	1
R. Sugden, Hulme, mechanic	1
T. B. Wilson, 61, Cannon-street, Manchester, merchant	1
*John Holroyd, Hulme, engineer	1

The number of directors is to be five, the first being the subscribers denoted by an asterisk; qualification, 100 "A" shares.

THE KOUTS CAR-STOVE CREMATION.

The above is the heading which the American *Sanitary Engineer* gives, concerning the mortality attending the railroad collision, on the 11th inst., on the Chicago and Atlantic Railroad near Kouts, Indiana, in which some 15 people lost their lives. "It was mainly due to two causes: first, the car-stove and the method of lighting; and secondly, the flimsy construction of some of the cars that were crushed to kindling wood between their heavier neighbours, which were comparatively uninjured. If this continued cremation must go on for another winter, it is fortunate that so early in the season the public should have another warning that will direct their attention to the inaction of the railway authorities, who, with very few exceptions, so far as we are informed, have done nothing yet to meet the just demands of the public and obey the laws enacted in several States looking to the removal of the car-stove and the introduction of heat from an outside source. About eight months have elapsed since legislation required companies in certain States to abandon the present dangerous method of heating and lighting cars. A few companies have striven honestly to introduce methods which are not monopolised by any one patentee, but which are available and within the means of any company which is willing to pay a reasonable price for them, subject only to such embarrassments as are involved in any important change. We regret to say, however, that there is too much evidence that railway companies are unwilling to incur the expense of perfecting such details as only actual use will demonstrate to be desirable, preferring to wait for other companies more public-spirited to make these experiments, and apparently indicating in the meantime a disposition, if the car-stove is abolished, to give their passengers the alternative of being frozen.

Buddensieck was sent to State's Prison for having buildings put up under his direction which were so constructed that they fell down and killed somebody. In view of the state of the art in the matter of heating at this day, and the ability to heat cars from an outside source, there is no reason why the directors of our railway companies should not be in a like manner punished if any lives are lost another year on the cars of their roads by reason of fire resulting from the present car stove.

In a subsequent issue we hope to indicate what has been done, and by what roads. Those who have been remiss in meeting a just public demand that they are entirely capable of fulfilling, may yet succeed in arousing public indignation to such a pitch that the next law enacted will make it homicide for the officers and directors of any road on which such casualties occur when it is proven that they have failed to provide their roads with such safeguards as every expert now knows is available."

Boiler Registry.—The *Shipping Gazette* remarks:—"The Board of Trade want to take in hand the supervision of boilers now, and they have prepared a Bill giving them the necessary powers. It has been read a first time, and stands over till next session. From the size and length of the Bill, it looks a rather formidable measure; but as ships classed at Lloyd's, or having a passenger certificate, are exempt from its operations, it will not affect the great majority of shipowners, and the rest may possess their souls in patience. Those to whom it is objectionable will put their case in the hands of the local associations. Every seaport of note has its Shipowners' Society now, and, through the Chamber of Shipping, maritime opinion can be focussed and brought directly to bear upon impending legislation. If there is a port wherein an association does not exist, the defect ought to be immediately remedied. Sooner or later we shall have another political quack at the head of the Board of Trade, and to that genus of budding statesmen 'loss of life at sea' is a captivating subject."

An Austrian Consul on British and German Merchants.—Herr Kreitner, the Austro-Hungarian Consul at Yokohama, in his report on the trade of Japan for the past year, refers to the respective proportions of British and German trade, and after showing by figures, says:—"The British merchant, proud of the great success of the nation, quite ignored until recently the apparently trivial efforts of others, and especially of his German competitors. He followed in the beaten tracks, let his customers come to his office, and exhibited small anxiety to meet their wishes, for the factories of England usually took count only of great production, and could pay but little attention to the special taste and seemingly unimportant requirements of the consumer. The German merchant in Japan acts in a wholly different manner. He does not disdain to acquire a knowledge of the language or even to seek out the Japanese in order to obtain their acquaintance and favour, and ultimately to enter into active connection with them by means of native agents. Moreover, he does not neglect the smallest order and exerts himself in every direction to meet the tastes and even the whims of his customers. The Japanese are gratified by these advances more than by the bluntness of the British, and, other things being equal, they prefer the Germans; and it would be peculiar if, with more advantageous business conditions, they neglected the German merchants."

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Application for Letters Patent.

*** When patents have been "communicated" the name and address of the communicating party are printed in italics.

18*th October*, 1887.

14,088. Looms, F. E. Aldrich.—(*M. F. Field, United States.*)
14,089. Getting Up the Pile of Sealskin Fabrics, H. Lister, Huddersfield.
14,090. Cutting Minerals, L. B. Atkinson, H. W. Ravenshaw, and F. Mori, Halifax.
14,091. Ventilating Railway Carriages, J. Anderson, Glasgow.
14,092. Dyeing Yarn in Bobbins, F. R. Kothen, Manchester.
14,093. Rivetting Machines, M. Arnold, London.
14,094. Atomisers, H. J. Allison.—(*A. L. Cohn, United States.*)
14,095. Refrigeration by Compression, H. J. Allison.—(*The De La Vergne Refrigerating Machine Company, United States.*)
14,096. Fur Drying Ovens, H. J. Allison.—(*J. J. Asch, United States.*)
14,097. Double Bolts, &c., for Railways, W. Parker, Sheffield.
14,098. Stone Sawing Machinery, D. and A. Hall, Leeds.
14,099. Lighting the Dials of Weighing Machines, W. Anyon, Manchester.
14,100. Pipe Joints, T. Fairies, Sheffield.
14,101. Waterfall Fireproof Partition, C. Gardner, Manchester.
14,102. Velocipede Lamps, H. Lucas, Birmingham.
14,103. Buffers for Weaving, T. Catlow and W. Atherton, Bradford.
14,104. Leathers for Drawing Off Wool, H. Kershaw and D. Todd, Bradford.
14,105. Holding Handles in the Heads of Hammers, W. Thomas, Birmingham.
14,106. Stirrups, F. H. Wincer, Birmingham.
14,107. Continuous Current Dynamo, N. G. Thompson, London.
14,108. Fire-lighters, J. Mitchell, Glasgow.
14,109. Railway Signalling Apparatus, J. Reid, Glasgow.
14,110. Escape Ladder for Theatres, &c., J. Smith, Cheshire.
14,111. Float-ball Cocks, H. Parkin and W. Clarke, Birmingham.
14,112. Washing Photographic Prints, W. A. M. Brown, Leeds.
14,113. Theatres, E. J. Tarver, London.
14,114. Raising the Globes of Oil Lamps, F. R. Baker, Birmingham.
14,115. Automatic Feed Motion, F. M. Ketton and C. W. Hollis, Nottingham.
14,116. Hollow Spindle Lathes, F. M. Ketton and C. W. Hollis, Nottingham.
14,117. Cast Iron Door Mat, E. W. Morgan, London.
14,118. Gas Lamps, C. M. Walker, London.
14,119. Transmitting Paddy Rice, W. Brock, jun., P. McAra, J. Walker, J. A. Birrell, and J. Adam, Glasgow.
14,120. Separating Fluids of Different Specific Gravities, W. Bergh, London.
14,121. Automatic Cream Separator, J. F. Duke, London.
14,122. Machine-tool Holder, D. S. Seymour, London.
14,123. Chuck, J. Johnston, London.
14,124. Finger Ring Measure, J. Kendal, London.
14,125. Avoiding Loss of Life, O. Buggiani, London.
14,126. Lawn Mowers, A. J. Boult.—(*J. P. Roger, France.*)
14,127. Chlorine, L. Mond and G. Eschellmann, Liverpool.
14,128. Studs for Collars and Cuffs, M. Weber, Liverpool.
14,129. Liquid Lubricating Compounds, T. H. Jones and E. O. Roberts, Liverpool.
14,130. Type-writing Machines, F. Myers, Liverpool.
14,131. Cigarettes, W. L. Wise.—(*H. F. Riedel, Germany.*)
14,132. Cigars, &c., W. L. Wise.—(*H. F. Riedel, Germany.*)
14,133. Incandescent Gas Lamp, R. Punshon, London.
14,134. Automatic Fire-escape, W. M. Taylor, Ashburton.
14,135. Self-starting Appliance for Gas Engines, G. Rolf and J. G. Patterson, Gateshead-on-Tyne.
14,136. Indicators for Cabs, &c, H. Haes, London.
14,137. Liquid Vortex Bearings, G. Shann, London.
14,138. Combined Sanitary Dust-bins and Cinder-sifters, H. Dean, London.
14,139. Carving Forks, G. S. Payne, Birmingham.
14,140. Permanent Way of Railways, J. Moser and E. Moeckel, London.
14,141. Fuel Economisers, G. C. Hawkins, London.
14,142. Railway Signalling Apparatus, C. Drewett, Lewisham.
14,143. Artistic Lithography, G. R. Hildyard, London.
14,144. Steering Velocipedes, W. Goulden, London.
14,145. Cigar-cutter and Match-box, A. Heilbuth, London.
14,146. Chucks for Lathes, C. and G. B. Taylor, Birmingham.
14,147. Motor, H. J. Haddan.—(*J. C. Bitter, Germany*)
14,148. Springs for Mattresses, &c., G. Downing.—(*E. Büschgens, France.*)
14,149. Berths for Railway Carriages, H. Jackson, London.
14,150. Reduction of Ores by Stamps, J. Coates, London.
14,151. Lamp Black for Printers' Ink, C. T. Bastand, London.
14,152. Harps, J. C. Dietz, London.
14,153. Injecting Liquid Hydrocarbons into Furnaces, E. N. Henwood, London.
14,154. Fertiliser, H. H. Lake.—(*P. B. Rose, United States.*)
14,155. Vacuum Brakes, L. P. Lawrence, London.
14,156. Knitted Stockings, H. H. Lake.—(*W. Esty and L. F. Busiel, United States.*)
14,157. Knitted Stockings, H. H. Lake.—(*W. Esty and L. F. Busiel, United States.*)
14,158. Knitting Machines, H. H. Lake.—(*W. Esty and L. F. Busiel, United States.*)
14,159. Percussion Fuses, F. L. and H. Tirmann, London.
14,160. Motor for Toys, J. Y. Johnson.—(*J. T. Marean, United States.*)
14,161. Motive Power, G. Schaub, London.
14,162. Banjos, J. Daniels, London.
14,163. Obtaining Motive Power, W. Griffiths, London.
14,164. Evaporation, &c., of Sugar-cane Juice, G. Fletcher, London.
14,165. Velocipedes, A. T. Goody, London.
14,166. Steam Engines, A. G. Mumford and A. Anthony, London.
14,167. Window Frames and Sashes, J. W. Greenslade, London.
14,168. Teaching Spelling, &c., J. H. Houghton, London.
14,169. Hydrometers and Saccharometers, J. J. Hicks, London.
14,170. Soles for Boots and Shoes, E. J. V. Earle, London.

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14,171. Magic Lantern Slide Stages and Carriers, J. H. Steward, London.
14,172. Bobbins or Spools, F. A. Marriott, Batley, near Leeds.
14,173. Corliss Valves and Trip Gear, E. M. Middlefell, London.
14,174. Obtaining Gold and Silver from Ores, &c., J. S. MacArthur, R. W. Forrest, and W. Forrest, London.
14,175. Corn Erasers, J. Morgan, Bristol.
14,176. Reel for Packing Woven Fabrics, H. R. Lister, Halifax.
14,177. Ball Bearings for the Shafts of Rollers of Washing Machines, J. Summerscales and H. C. Longsdon, Halifax.
14,178. Dobbies of Looms for Weaving, C. Catlow, Halifax.
14,179. Cutting Gloves, J. Whitby and J. Sutton, Yeovil.
14,180. Railway Engines and Trains, &c., M. Raymond and F. Raymond, London.
14,181. Carver Fork and Knife Sharpener, T. Rines, Scarborough.
14,182. Bye-pass Cocks and Valves, T. Kirk, Birmingham.
14,183. Securing Picks to their Shafts, T. Trussell, Nottingham.
14,184. Fasteners for Doors and Windows, J. G. W. Fairbairn and R. Jones, Birmingham.
14,185. Cooling Butter, &c., J. Bryce, Glasgow.
14,186. Infants' Chairs, A. Plant, Glasgow.
14,187. Soap, W. Lincolne, Glasgow.
14,188. Stoppering Bottles, J. R. Hargrove, Birmingham.
14,189. Rings of Ring-spinning Frames, H. Rothwell and F. Leech, Manchester.
14,190. Music Stools, J. Whatmough, Oldham.
14,191. Ironing Machines, T. Lowe, Old Radford.
14,192. Forging Machines, W. H. Dorman, Stafford.
14,193. Fire Guards, T. Barker, Birmingham.
14,194. Toy Spades, J. Austin, Birmingham.
14,195. Bakers' Ovens, J. Williams, Llanelly.
14,196. Treating Rhea, &c., H. M. Girdwood, Manchester.
14,197. Steam Traps, H. Woffidin, Leeds.
14,198. Liquid Meters, J. Mitchell, Glasgow.
14,199. Furnaces, C. J. Henderson, Hawick.
14,200. Stirrups, F. Bosshardt.—(*C. Grassi, P. Brigatti, and L. Pirola, Italy.*)
14,201. Non-conducting Composition, F. Bosshardt.—(*J. Cazeneuve, France.*)
14,202. Cycles, J. I. Warman, London.
14,203. Miniature Two Wheel Vehicles, W. Wilson, London.
14,204. Binding Devices, J. R. Hard and T. Wilson, London.
14,205. Causing Candlesticks to Adhere to Glass, H. A. Marshall, London.
14,206. Automatic Draught Excluder for Doors, D. F. Sorfleet, London.
14,207. Steam Generators, J. Ashworth and W. Kneen, London.
14,208. Fireplaces, J. Ashworth and W. Kneen, London.
14,209. Preventing Corrosion in Boilers, W. H. Rusden, London.
14,210. Baths, W. Wasbrough, London.
14,211. Strainer, T. H. Moorhead, London.
14,212. Electrolysis of Aqueous Solutions, A. S. Elmore, London.
14,213. Knee Protector, J. R. Rowland, London.
14,214. Dust-collecting Apparatus, Messrs. Buntzel, Herrick, and W. Trautmann, London.
14,215. Sparkling Effect for Advertising, E. and F. Smith, London.
14,216. Firing Naval Ordnance, P. J. R. Crampton, London.
14,217. Boot Fastenings, R. L. Gilmore, London.
14,218. Pipe Tongs, &c., C. M. Wilkins and H. Geary, London.
14,219. Stop Valves, L. F. Pile, London.
14,220. Perambulators, W. Hewitt, London.
14,221. Reduction of Lead, &c., A. B. Cunningham, London.
14,222. Lamps for Burning Liquid Hydrocarbons, H. Nicoll, London.
14,223. Screw Stoppers, H. Barrett and J. J. Varley, London.
14,224. Lags used in Engines of Looms, K. Jowett, Bradford.
14,225. Making Up Packs of Cards, P. Gauchot, London.
14,226. Measuring Electric Currents, M. J. R. Jacquemier, London.
14,227. Permanent Way of Railways, A. B. Paulet, London.
14,228. Evaporating, &c., Apparatus, W. F. Pamphlett, London.
14,229. Wood Paving, H. H. Lake.—(*A. Lauzani, Italy.*)
14,230. Removing Cartridge Cases, J. A. Norton, London.
14,231. Separating Liquids, H. H. Lake.—(*O. S. Andersen, Valby.*)
14,232. Machine for Counting, &c., Metal Plates, M. F. H. Lintz, London.
14,233. Effecting Circulation of Water to Boilers, D. Thomson, London.

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14,234. Tappet Locking, W. F. Burleigh, London.
14,235. Securing Churns in Vehicles, W. R. Sewell, London.
14,236. Adjustable Ball Bearings for Velocipedes, T. C. Pullinger and H. Jelley, London.
14,237. Railway Carriage Windows, F. Gill, Sunderland.
14,238. Taking-up Apparatus in Knitting, &c., Machinery, W. B. Maxfield.—(*A. Freund, Germany.*)
14,239. Skewers, &c., I. Wallwork, Hurst.
14,240. Self-acting Fluzing, J. Ellison, Bolton.
14,241. Hydraulic Transmission of Power, W. H. Watkinson, Keighley.
14,242. Self-generating Gas Lamps, A. Neilson, Glasgow.
14,243. Window, &c., Sashes, J. E. L. Dowman, Glenbrook.
14,244. Manufacturing Hats, W. H. Blackwell, Hooley Hill.
14,245. Furniture Polish, F. Thake and J. Forrest, Gospel Oak.
14,246. Taps, H. Meynell, Bloxwich.
14,247. Dynamometers, W. Parkinson. — (*J. Wallace, India.*)
14,248. Manufacture of Rollers for Castors, F. Hudson, Birmingham.
14,249. Chasing Projectiles, &c., H. Broadbent, Halifax.
14,250. Gas Stove, T. Fletcher, Manchester.
14,251. Furnaces, F. Hazlett and H. McCrudden, London.
14,252. Self-winding Clocks, J. A. Lund, London.
14,253. Hosiery, W. F. and S. C. Baines, Leicester.
14,254. Ring Spinning Machines, &c., W. Lancaster, Halifax.
14,255. Conical-shaped Cooking Oven, D. Kellie and N. Farrar, Blackpool.
14,256. Paraffin Lamps, T. Watson, Belfast.
14,257. Scrubbing Device, J. A. Wood, Keighley.
14,258. Apparatus for Delivering a Spray of Perfume, E. G. Colton and J. Glover, London.
14,259. Primary Batteries for Electric Signals, C. Hall and H. Binko, London.
14,260. Preventing Induction in Electrical Conductors, S. C. Drew, London.
14,261. Cooks' Sieves, J. F. Golding and J. Gilbert, London.
14,262. Mouthpieces to Telephones, T. B. Garnett.—(*J. M. Blake, New York.*)
14,263. Rotary Machine for Blowing Furnaces, J. Edey and G. Wright, London.
14,264. Harze or Resin Spirit Painting, J. Elliott, London.
14,265. Dividing the Threads in Condensers, J. Stanhope, A. Maud, and J. W. Hainsworth, London.
14,266. Jack Joints for Looms, &c., W. H. Hudson, London.
14,267. Winding Frames, L. Haslam, C. Marshall, and T. Brown, London.
14,268. Ascertaining the Density of Human Milk, A. L. Rousse, London.

14,269. Utilising the Space between the Cylinder and Jackets of Engines, R. Hutchinson, London.
14,270. Sheet Copper, B. J. B. Mills.—(*E. Emerson, United States.*)
14,271. Apparatus for Preventing Upsetting of Converters, S. J. Evans, London.
14,272. Stay Busks, R., H., and B. G. Simpson, Sheffield.
14,273. Separating the Plates of Secondary Batteries, A. J. Littleton, Sydenham.
14,274. Model Holders, H. Marle, Birmingham.
14,275. Air Compressors, W. A. Pitt, New York.
14,276. Employing Heated Air in Drying Vegetables, S. C. Davidson, London.
14,277. Connecting the Ends of Double-loop Cotton Bands, S. Rowbottom, London.
14,278. Couplings for Railway Vehicles, A. B. Ibbotson, London.
14,279. Gas Producers, J. W. Sheel, London.
14,280. Compressing Drugs, S. M. Burroughs and Messrs. Burroughs, Wellcome, and Co., London.
14,281. Fireplaces, J. B. Petter, London.
14,282. Stoppering Bottles for Liquids, T. Terrell, London.
14,283. Churns, R. Cahn, London.
14,284. Locks, W. T. Milliken, London.
14,285. Mercurial Antiseptic Soap, J. Thomson, London.
14 286. Laying Asphalte Roadways, J. Tennyson, London.
14,287. Fastening Show-case Doors, P. Keogan, Birmingham.
14,288. Incombustible Batten for Electric Lighting of Theatres, E. L. Berry, London.
14.289. Capsuling Bottles to Prevent Fraud, R. S. Dupré, London.
14,290. Automatic Appliance for Protection against Fire, T. E. Wilson, London
14,291. Picking Motion for Use in Looms, J. Monk, London.
14,292. Suspender End, W. W. Horn.—(*C. Voorhis and A. Shenfield, United States.*)
14,293. Button Loop for Suspender Ends, W. W. Horn.—(*C. Voorhis and A. Shenfield, United States.*)
14,294. Sewer Sanitation, W. J. Webb, London.
14,295. Respirators, E. Kent, London.
14,296. Metal Chests, F. J. King, London.
14.297. Lamps, &c., A. Thompson and J. H. Davies, London.

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14,298. Corks for Stopping Bottles, A. Macindoe, Manchester.
14,299. Steam Boilers, R., W. H. Kay, J. Taylor and J. Whittaker, Manchester.
14,300. Lawn Tennis Balls, H. H. Waddington, Manchester.
14,301. Locks and Keys, H. Edwards, Anglesea.
14,302. Heel Lifting for Boots, &c., D. W. Fessey, London.
14,303. Automatic Pressure Regulating Water Cock, T. Varley, Birmingham.
14,304. Heating Steam in Boilers, M. P. W. Boulton, London.
14,305. Construction of Fire Lighters, W. Weller, jun., London.
14,306. Petroleum Lamps, A. J. Eli, London.
14,307. Weight Self Indicator, T. J. Mackay, Birmingham.
14,308. Column Furniture for Printing Presses, T. M. Huck et Cie., Germany.
14,309. Ship's Steering Foot Board, W. Fieldhouse, Grimsby.
14,310. Lace-making Machinery, J. Wilson, Glasgow.
14,311. Casks, &c., E. G. Hooper, London.
14,312. Roasting Jack and Spring Balance, H. R. Cottrell and H. Ely, Birmingham.
14,313. Cylinder Combination Compass, W. T. and C. Smith, Birmingham.
14,314. Gas Heating Stove, T. Green and W. Stelfox, Hulme.
14,315. Economising Steam in Engines, J. Nelson, Newcastle-upon-Tyne.
14,316. Fish Hooks, H. Cholmondeley - Pennell, London.
14,317. Paper Boot Last, J. J. Mee and R. Adgie, North Shields.
14,318. Wrought Iron Door Latches, F. H. Curtis, Wolverhampton.
14,319. Drying Grain, &c., J. Milne, Glasgow.
14,320. Bung and Vent-Pegs for Barrels, J. H. Swift, Halifax.
14,321. Printing on Tin-plates, T. H. Rees, London.
14,322. Covering Electrical Wires, A. W. Slater, London.
14,323. Change Board, J. Anderssen, Norway.
14,324. Fast-boiling Kettle Boiler, G. F. Andrews, London.
14,325. Utilising Producing-Gas, H. C. Bull and Co., and H. C. Bull, London.
14,326. Portable Self Life-saving Fire-escape, E. Clarke, London.
14,327. Knit Felt Hat Bodies with Fur or Wool, G., S., and G. R. Ainsworth, London.
14,328. Fixing Knobs to Bedsteads, &c., H. W. Andrews, Southsea.
14,329. Electrical Contact Makers, &c., E. Price, London.
14,330. Fastener for Corsets, &c., J. Record, Birmingham.
14,331. Tongues of Boots, J. Whitehead, Birmingham.
14,332. Ball Bearings for Velocipedes, &c., C. M. Linley and J. Biggs, London.
14,333. Aerial Railway, C. Lucop, London.
14.334. Game of Skill, Vincenzo, Count di Tergolina, London.
14,335. Game of Skill, Vincenzo, Count di Tergolina, London.
14,336. Underframes for Four-wheeled Vehicles, Vincenzo, Count di Tergolina, London.
14,337. Brush Holders, G. Gregory, London.
14,338. Habit Collars, F. White, London.
14,339. Issuing Tickets on Vehicles, G. White, Springbrook.
14,340. Saucepans, W. P. Simpson, London.
14,341. Fittings for the Moving Toothed Quadrants of Spinning Mules, J. Allan, Glasgow.
14,342. Looms for Weaving, J. McMurray, Glasgow.
14,343. Wheels for Vehicles, J. Brigham and R. Brigham, Glasgow.
14,344. Hydraulic Press, T. C. R. Horsfield and R. Porter, London.
14,345. Hydrate of Baryta and of Strontia, &c., the Tyne Alkali Company and T. Gibb, London.
14,346. Bell-pull Electric Light Switch, A. P. Lundberg, London.
14,347. Desks for Pianofortes, &c., A. Sieber, London.
14,348. Sheet Metal Cans, H. Inglis, London.
14,349. Cocks and Taps, R. E. Goolden, London.
14,350. Albums, G. E. Chapman, London.
14,351. Boots and Shoes, C. Lion, London.
14,352. Looms for Weaving, G. M. Wilson, London.
14,353. Braces, &c., A. M. Clark.—(*I. J. Chidley, Australia.*)
14,354. Car Axles, E. Peckham, London.
14,355. Ring Spinning, T. E. Wilson, London.
14,356. Production of Floride of Aluminium, L. Grabau, London.

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14,357. Horseshoe Nails, G. H. Parkin, London.
14,358. Boxes, D. Clark, London.
14,359. Promoting Circulation in Water-tube Boilers, C. C. S. Knap, Birmingham.
14,360. Portable Baths Heated by Gas, A. Sweet, London.
14,361. Circular Carriage Drive for Recreation, J. R. Fielding, Rochdale
14,362. Tun-dishes for Funnels, &c., S. Auden, Birmingham.
14,363. Pulleys, J. E. Weyman, Guildford.
14,364. Outlets of Sewage Tanks, J. Greenwood, Keighley.
14,365. Bottle Cleaning Machinery, B. Binnington, London.
14,366. Gas Motors, D. Clerk, Glasgow.
14,367. Cooking Ranges, D. Cowan, Glasgow.
14,368. School Furniture, J. W. Burroughs, Manchester.
14,369. Screw Nuts, R. S. Wood, E. N. Dunderdale, and L. W. Atkinson, Manchester.
14,370. Woven Fabrics, B. Barraclough, Bradford.
14,371. Extracting Metal from Tin, J. Toy and S. H. Stephens, Cornwall.
14,372. Velocipedes, W. Giffard, Salford.
14,373. Hackle Gills, M. Holroyd, Bradford.
14,374. Stems for Holding Brushes, &c., T. Hill, Kingston-upon-Hull.
14,375. Rollers for Textile Machinery, W. A. Whitehead and H. Midgley, Bradford.
14,376. Felt Hats, R. Pintner, Manchester.
14,377. Horseshoes, W. G. R. A. Cox, London.
14,378. Mechanical Refrigeration, S. Puplett and J. L. Rigg, Knowle.
14,379. Extracting Weeds, W. Birch, London.
14,380. Steering Joints for Bicycles, C. Inwood, Gravesend.
14,381. Flushing Cisterns, B. R. Banks, London.
14,382. Firemen's Dresses for Protection against Fire, C. Wraa, London.
14,383. Automatic Sale and Delivery of Goods, W. H. Davis, London.
14,384. Water-closets, R. Hocking, London.
14,385. Metallic Packings for Pistons, &c., T. Downie, Liverpool.
14,386. Arching Wire Brims for Hats, T. Penney, London.
14,387. Water-closets and Urinals, S. S. Hellyer, London.
14,388. Scoring Games, C. E. Clowes, London.
14,389. Brick Machinery, S. G. Rhodes, London.
14,390. Electric Firing Fuse or Primer, R. Morris, London.
14,391. Motor Engines, H. Rogers and E. J. Curtin, London.
14,392. Cement, G. J. Snelus, W. Whamond, and T. Gibb, London.
14,393. Cements, G. J. Snelus, W. Whamond, and T. Gibb, London.
14,394. Cements, G. J. Snelus, W. Whamond, and T. Gibb, London.
14,395. Securing the Mouths of Travelling Bags, &c., S. Malo, London.
14,396. Tram Rail Groove Cleaners, J. Record and H. J. Jordan, London.
14,397. Time Indicator for Candles, W. S. Simpson, London.
14,398. Musical Spin Top, W. S. Simpson and L. B. Bertram, London.
14,399. Screws, H. K. Jones, London.
14,400. Screw Propeller, J. Sherman, London.
14,401. Mute for Wind Instruments, L. Standring, London.
14,402. Dressing Bags, &c., M. Wolfsky, London.
14,403. Sawing Apparatus, A. B. E. Nilson and H. L. Mathiesen, London.
14,404. Heating Steam, M. P. W. Boulton, London.
14,405. Domestic or Open Fire-grates, J. G. Cathie, London.

24th October, 1887.

14,406. Brackets for Carrying the Guiding Roller and Stripping Brush of Carding Engines, W. Taylor, Manchester.
14,407. Depositing the Dead, J. Kirby, London.
14,408. Cigar Cutter, J. Satchwell and A. Lloyd, Birmingham.
14,409. Woven Fabrics, B. Barraclough, Bradford.
14,410. Intensification of Light, J. H. da Fonseca, Stockport.
14,411. Rammer, C. Dixon, Birmingham.
14,412. Apparatus for Filling Sausages, P. J. Catterall, Cheetham.
14,413. Fuel Economiser, &c., J. C. Jopling, Sunderland.
14,414. Game with Seven Pins and a Ball, T. Wright and G. M. Hickman, Northampton.
14,415. Safety Lamps, W. H. Edwards and C. Britton, Birmingham.
14,416. Telephonic Apparatus, J. L. Corbett, Glasgow.
14,417. Candlesticks, R. G. Newton, Birmingham.
14,418. Lamps for Burning Solid Hydro-carbons, W. Burns and The Cera Light Company, Glasgow.
14,419. Haulage Hook, W. G. Robinson, Elland.
14,420. Cranes, G. C. Marks, Birmingham.
14,421. Automatic Casement Stay, E. and J. M. Verity, and B. Banks, Leeds.
14,422. Door Springs and Checks, G. F. Newman, Birmingham.
14,423. Railways for Recreation, F. H. Anderton and W. Marshall, Sheffield.
14,424. Aneroid Barometers, H. W. Cook, Stondon-Massey.
14,425. Movable Reversible Calender, W. Coulter, Manchester.
14,426. Producing Voltaic Electricity, Sir C. S. Forbes, London.
14,427. Wire, C. Campbell, Birmingham.
14,428. Regulating the Supply of Gas, J. Enright, London.
14,429. Impregnating Chamois Skin, J. E. Darby and E. Blakeslee, London.
14,430. Sewing Machines, F. O. Jerram, Liverpool.
14,431. Exit Ventilators for Rooms, J. W. Gibbs, Liverpool.
14,432. Gas Lamps, J. Walker, Liverpool.
14,433. Driving Gear of Flour-sifters, G. Daverio, London.
14,434. Mode of Mounting Crochet Hooks, C. James, Birmingham.
14,435. Brake System, A. C. T. Bautain, London.
14,436. Hammer-heads for Pianofortes, W. H. Taplin, London.
14,437. Gas Mains, C. P. Cotton, London.
14,438. Dress Stands, H. H. Leigh.—(*J. J. Muller, United States.*)
14,439. Sizing Coal, A. S. Douglas and R. H. Oughton, London.
14,440. Pure Ice, L. Sterne.—(*J. C. de la Vergne, United States.*)
14,441. Wire-work Cinder Cremater, L. Wood, London.
14,442. Fireproof Curtains for Theatres, &c., G. A. Farini, London.
14,443. Undershirts and Underclothing, A. T. Wootton and W. Clifton, Nottingham.
14,444. Cocking and Safe Hammerless Guns and Rifles, E. Harrison and E. G. Anson, London.
14,445. Insulation of Submarine Telegraphic Cables, R. Haddan.—(*E. G. Prillwitz, Germany.*)
14,446. Chairs, F. Vogel, London.
14,447. Torpedo, H. N. Morgan, London.
14,448. Melting Snow in Roads, &c., H. N. Morgan, London.
14,449. Striking Apparatus for Clocks, J. A. Lund, London.
14,450. Stamping Machines, P. Ellis, London.
14,451. Calcining and Melting Copper, &c., T. Elford, G. Ackland, and R. Morgan, London.
14,452. Steel and Malleable Iron, J. A. Crawford and R. M. Black, London.
14,453. Driving Wheels of Road Locomotives, F. B. Beskow, London.
14,454. Ironing or Calendering Linen, C. S. Crabtree, London.
14,455. Preventing Accidents in Mines, J. Griffin, London.
14,456. Ventilators, G. A. Maltster, London.
14,457. Applying Superheated Steam to the Furnaces of Steam Boilers, J. C. Ghest, London.
14,458. Blasting of Coal in Mines, F. von Ehrenwerth, London.
14,459. Producing Peptone, A. Brünn, London.
14,460. Sink Cones and Sink Traps, P. J. Davies, London.
14,461. Electric Accumulators, &c., A. Stetson, London.
14,462. Taps or Cocks for Drawing off Liquids, J. B. Fisher, London.
14,463. Capsuling Bottles, E. Tuteur, London
14,464. Diamido Compounds, G. Pitt.—(*A. Weinberg, Prussia.*)

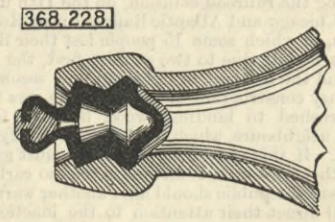
SELECTED AMERICAN PATENTS.

(From the United States' Patent Office Official Gazette.)

368,228. Bottle Stopper, *C. L. Morehouse, Brooklyn, N.Y.—Filed December 16th*, 1886.

Claim.—(1) The combination, with a rubber stopper having a curved bottom, and a recess in said curved bottom, of a flexible piece of cork vulcanised to the under side of said stopper within the recess in said under side, substantially as shown and described. (2) The combination, with a rubber stopper having a curved bottom, of a flexible layer of cork vulcanised to said curved bottom of the stopper, substantially as shown and described. (3) The combination, with a hollow rubber bottle stopper having a neck, of a metal plug held in said neck, substantially as shown and

368,228.

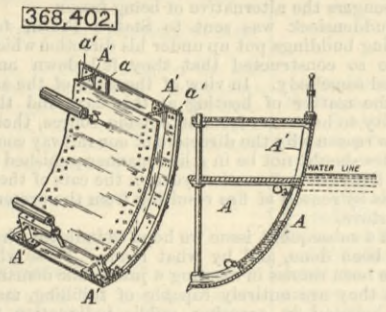


described. (4) The combination, with a soft rubber bottle stopper having a rubber neck, of a tapered plug in said neck, a stem on the plug, and a plate on the upper end of the stem and above the top of the neck, substantially as shown and described. (5) A soft rubber bottle stopper having a hollow neck lined with muslin or linen, substantially as shown and described. (6) The combination, with a soft rubber bottle stopper having a hollow neck, a lining of muslin or linen in said neck, and a tapered metal plug in said neck, substantially as shown and described.

368,402. Steam Condensing Appliance, *A. L. Kirkland, Boston, and T. A. Lynch, McKeesport.—Filed January 10th*, 1887.

Claim.—(1) The combination, with the hold of a vessel, of the ribs A^1, having perforated flanges a a^1, inner lining, B, with flange B^1 at its lower end, and outer covering, A, whereby a watertight compartment is formed below the water-line, and suitable supply and exhaust pipes arranged at the top and bottom of said chamber and connected with the engine and boiler, substantially as described, for the purposes set forth. (2) The combination, in a steam condenser for marine engines, with the hull of a vessel having a series of watertight compartments formed therein between the ribs and inner and outer shell and below its water-line,

368,402.

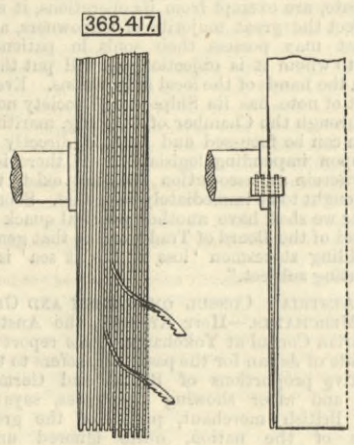


of a main pipe connected with the steam exhaust of the engine, extending along the top of said chambers, and supplied with a series of short branch pipes with valves therein, connecting said main pipe with each one of the series of compartments, and a similar main pipe extending along the bottom of the chambers, and connected with the boiler and each of the series of compartments by a series of short branch pipes having valves therein, substantially as and for the purposes described and shown.

368,417. Manufacture of Toothed Cylinders for Textile Machinery, *H. L. Moulton and W. H. Clarkson, Philadelphia, Pa.—Filed March 26th*, 1887.

Claim.—(1) The within-described toothed cylinder for textile machinery, said cylinder having a multiple thread and a toothed strip wound in each thread, all substantially as specified. (2) The mode herein de-

368,417.

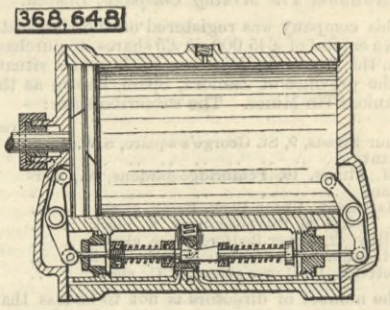


scribed of cutting a multiple thread in a cylinder by means of a single multiple-bit tool, said mode consisting in feeding the tool at a rate of speed which is as much greater than the gauge of the tool as the number of threads to be produced is greater than a single thread, all substantially as specified.

368,648. Pump Valve Gear, *J. F. Carpenter, Berlin, Germany.—Filed April 8th*, 1887.

Claim.—(1) A pump valve gear comprising a cylinder and piston, a slide valve and its stem loosely connected therewith and provided with springs, and tappets arranged in alignment with the said stem and in the path of travel of the piston, substantially as and for the purpose specified. (2) The combination, substantially as described, of a slide valve, a locking device therefor, a stem loosely connected to the said valve and controlling its locking device, springs on said stem acting expansively, and a loose connection with the main piston, substantially as described. (3) A cylinder and a reciprocating piston therein, a valve chest and a slide valve therein, a stem loosely connected with said slide valve, and tappets moved by the piston to give the initial movement to the valve, combined with an auxiliary or secondary motor set in operation at the completion of the movement of the piston to complete the movement of the valve, substantially as described. (4) A cylinder and a reciprocating piston therein, a valve chest and a slide valve therein, a stem loosely connected with said slide valve, tappets moved by the piston to give the initial movement to the valve, and an auxiliary or secondary motor set in

368,648.

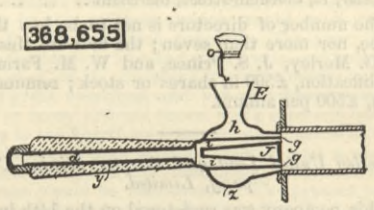


operation at the completion of the movement of the piston to complete the movement of the valve, the piston, the slide valve and its stem, the tappets, and the auxiliary or secondary motor being arranged wholly within the steam space, combined with a single head at each end for enclosing the said parts, substantially as described.

368,655. Boiler-tube Cleaner, *H. L. Currier, Lynn, Mass.—Filed April 16th*, 1887.

Claim.—(1) The improved nozzle herein described, the same consisting of the pipe d, having an insulating covering y, said tube being provided with the bulb z, having the tubular partition g, cone-shaped guide J, and hopper E, substantially as described. (2) In a device of the character described, the bulb z, provided with a hopper E for admitting sand thereto, and interiorly divided into the chambers h i by a horizontally arranged tubular partition g, in combination with the cone-shaped guide J, horizontally disposed within the chamber i and secured at its smaller end to the walls of said bulb, the tube d opening into said bulb, and being screw-threaded at its outer end to

368,655.

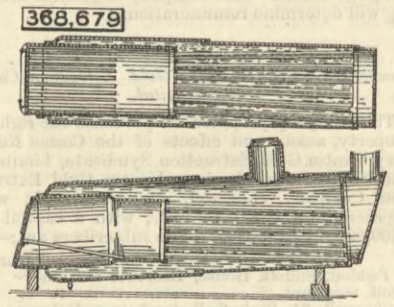


receive a steam or air pipe, substantially as shown and described. (3) In a device for cleaning boiler tubes, the combination of the following instrumentalities, to wit—a tubular body, a bulb secured to said body and divided into two chambers by a horizontally arranged tubular partition, a hopper opening into the outer chamber in said bulb for admitting sand, and a cone-shaped deflecting guide horizontally disposed within the inner chamber and secured at its smaller end to the walls of said bulb, substantially as set forth.

368,679. Steam Boiler, *J. A. Mumford, Hantsport, Nova Scotia, Canada.—Filed February 5th*, 1887.

Claim.—In a steam boiler, the combination, with the main casing, of a fire-box therein, two flue sheets substantially parallel, one of them forming the end of the fire-box, and the tubular flues located entirely below the water-line secured to the two sheets, the

368,679.

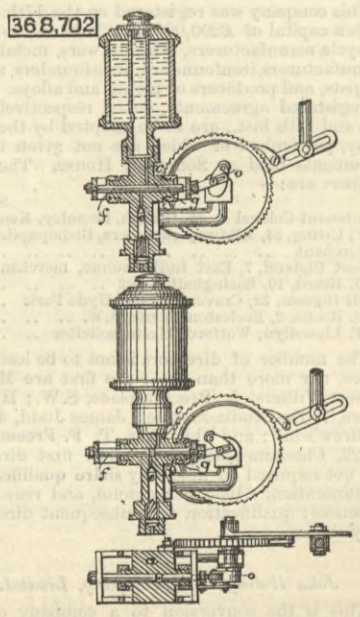


ends of the flues in the sheet nearest the rear or stack end of the boiler being separated farther apart than those at the fire-box end, substantially as described. The combination, with the inclined main boiler shell, of a fire-box composed of a plurality of cylindrical sections gradually decreasing in size toward the rear, and the substantially horizontal flues connected therewith, substantially as described.

368,702. Lubricator, *J. G. G. E. Bischoff, Hamburg, Germany.—Filed June 1st*, 1887.

Claim.—In apparatus for lubricating working cylinders of steam engines, pumps, &c., the combina-

368,702.



tion of the two pistons f and g with the reciprocating slide a and the finger o, together with the cylinder a, provided with canals c and e, substantially as and for the purpose specified.